National Aeronautics and Space Administration

May 10, 2000
NRA 00-OSS-05

RESEARCH ANNOUNCEMENT

FAR ULTRAVIOLET SPECTROSCOPIC EXPLORER (FUSE)

GUEST INVESTIGATOR PROGRAM

Cycle 2

Notices of Intent Due:	**June 12, 2000**
Proposals Due:	**July 14, 2000**

OMB Approval No. 2700-0087

FAR ULTRAVIOLET SPECTROSCOPIC EXPLORER
(FUSE)

GUEST INVESTIGATOR PROGRAM

Cycle 2

NASA Research Announcement
Soliciting Proposals for Basic Research

NRA 00-OSS-05

Release Date: May 10, 2000

Notices of Intent Due Date: June 12, 2000

Proposal Due Date: July 14, 2000

Office of Space Science
National Aeronautics and Space Administration
Washington, DC 20546-0001

FAR ULTRAVIOLET SPECTROSCOPIC EXPLORER
(FUSE)

GUEST INVESTIGATOR PROGRAM

Cycle 2

This NASA Research Announcement (NRA) solicits basic research proposals for participation in the National Aeronautics and Space Administration (NASA) program for space science observations and subsequent analysis of the resultant data from the Far Ultraviolet Spectroscopic Explorer (FUSE). The primary goal of the FUSE mission is the investigation of the nature and physics of interstellar and intergalactic gas through the use of high-resolution spectroscopy of the far ultraviolet (905-1187 Å) radiation of distant sources.

FUSE is a Principal Investigator (PI)-class NASA mission. The FUSE PI, Dr. Warren Moos of Johns Hopkins University (JHU), is responsible to NASA for mission design, development, and operations. The FUSE PI is also responsible for achieving the mission's primary scientific objectives and has been granted a significant fraction of the observing time for this purpose. The FUSE mission is being developed in cooperation with Canada and France, who share in the observing time.

Although FUSE is a PI-Class mission, a significant fraction of the FUSE observing time is available to the general astronomical community. The FUSE Guest Investigator (GI) Program is intended to enhance the scientific return from the mission by drawing on the astronomical community to use FUSE to conduct independent investigations.

FUSE was launched on June 24, 1999, and is planned as a three-year mission. This NRA is the second announcement for the FUSE GI Program and solicits proposals only for Cycle 2 of the mission. Cycle 1 science operations began December 1, 1999. Cycle 2 is planned for the 12-month period beginning in December 2000. Approximately 3600 kiloseconds of on-target exposure time will be allocated to GI programs in Cycle 2.

Participation in the FUSE GI Program is open to all categories of organizations, foreign and domestic, including industry, educational institutions, NASA Centers, nonprofit organizations, and other Government agencies. Proposals may be submitted at any time before the proposal due date. Late proposals will be held for the next review cycle. Scientists planning to propose should submit a Notice of Intent in order to facilitate the timely selection of proposal review panels.

Proposals received in response to this NRA will be evaluated in a competitive scientific peer review conducted by NASA Headquarters, with a goal of announcing the selection approximately two months after the proposal due date. Proposals will be reviewed by panels organized by research area and/or topic. Budgets should not be submitted with observing proposals. Only after a proposal has been awarded observing time, based on scientific peer review, will a budget and institutional signature be required. A detailed schedule specifying proposal deadlines and important mission milestones is provided in Appendix C to this NRA.

Limited funds for awards under this NRA are expected to be available to investigators at U.S. institutions subject to the annual NASA budget cycle. The Government's obligation to make awards is contingent upon the availability of appropriated funds from which payment for award purposes can be made and the receipt of proposals which the Government determines are acceptable for award under this NRA. It is anticipated that approximately $3.7 million will be available to support the order of 60 to 70 U.S. investigators for Cycle 2. In most cases, investigations selected for award under this NRA will be funded through the use of grants.

Proposers whose investigations are awarded observing time will have sole use of their data for six months after the processed data is placed in the FUSE data archive. After this time, the data will be available to the public.

Education and the enhancement of public understanding of space science are vital and integral parts of all NASA space science missions and research programs. Therefore, NASA OSS encourages any U.S. proposer to this NRA to submit an optional Education/Public Outreach (E/PO) component with their research program in accordance with the guidelines in Appendix H. NASA has identified funds independent of the FUSE GI program to support E/PO activities in the Office of Space Science. Note that originality is not a criterion of such E/PO tasks; rather the important factor is that a tenable task of merit be proposed. Also, E/PO proposals are to be submitted **only** in conjunction with the budget phase of the proposal process (see Appendix C.4) in accordance with the procedures for E/PO proposals given in Appendix H.

Further details relevant to the FUSE GI Program are included in the Appendices listed below. This NRA, its Appendices, and relevant reference documents may be downloaded directly via the World Wide Web at the addresses provided. Individuals not having access to the Internet may request printed copies of this Announcement and reference documents at the address given below.

Appendix A gives an overview of the mission and describes the observing opportunity. Appendix B gives the general instructions for responding to NASA Research Announcements. Appendix C, which supersedes and augments Appendix B, provides additional, NRA-specific information on the GI program, proposal submission and subsequent evaluation, selection, and implementation. Appendix D lists the targets reserved for the PI team for Cycle 2. GI targets planned for observation during Cycle 1 are listed in Appendix E. Appendix F lists the calibration targets. Appendix G contains the abstracts describing the PI team observing programs.

Technical and reference documents are available interactively from the FUSE Science Center at JHU over the World Wide Web, for download via the World Wide Web or anonymous ftp, and in hard copy by request at the address given below. Of particular value is *The FUSE Observer's Guide*, which contains an overview of the mission capabilities, a detailed instrument description, and information about proposing for FUSE observing time (e.g., instructions for assessing feasibility, instrument summary, constraint summaries, exposure time calculations).

IDENTIFIER:	NRA 00-OSS-05
SUBMIT NOTICES OF INTENT TO PROPOSE ONLINE AT:	http://props.oss.hq.nasa.gov
SUBMIT NOTICES OF INTENT BY:	June 12, 2000
PROPOSAL DUE DATE:	July 14, 2000
PROPOSAL SUBMISSION REQUIREMENTS:	12 printed copies **plus** Electronic submission of ASCII Proposal Form **plus** Completion of online proposal Cover Page/ Proposal summary form at: http:// props.oss.hq.nasa.gov
SUBMIT ELECTRONIC PROPOSAL FORM TO:	fuseprop@fusewww.gsfc.nasa.gov
SUBMIT PRINTED PROPOSALS TO:	FUSE Guest Investigator Program NASA Peer Review Services GST Corporation 500 E St., SW, Suite 200 Washington, DC 20024-2760 USA
POINT OF CONTACT FOR COMMERCIAL DELIVERY:	TEL: 202-479-9030
SUBMIT EDUCATION/PUBLIC OUTREACH PROPOSALS TO:	See Appendix H
SELECTING OFFICIAL:	Director Research Program Management Division Office of Space Science
OBTAIN ADDITIONAL INFORMATION ABOUT THE NRA FROM:	Dr. Hashima Hasan FUSE Program Scientist Office of Space Science Code SR National Aeronautics and Space Administration Washington, DC 20546-0001 USA Tel: 202-358-0692 Fax: 202-358-3097 E-mail: hashima.hasan@hq.nasa.gov

DIRECT SCIENTIFIC AND TECHNICAL QUESTIONS ABOUT THE FUSE GI PROGRAM AND REQUESTS FOR PRINTED APPENDICIES AND DOCUMENTATION TO:	Dr. George Sonneborn FUSE Project Scientist Laboratory for Astronomy and Solar Physics Code 681 Goddard Space Flight Center National Aeronautics and Space Administration Greenbelt, MD 20771 USA Tel: 301-286-3665 Fax: 301-286-1753 E-mail: george.sonneborn@gsfc.nasa.gov
OBTAIN TECHNICAL INFORMATION ABOUT FUSE FROM:	Dr. B-G Andersson FUSE Guest Investigator Officer Department of Physics and Astronomy Johns Hopkins University Baltimore, MD 21218 USA Tel: 410-516-8378 Fax: 410-516-5494 E-mail: fuse_support@pha.jhu.edu

RETRIEVE NRA, APPENDICES, AND INSTRUCTIONS ELECTRONICALLY FROM:
<http://spacescience.nasa.gov/> and select "Research Opportunities"
OR <http://fusewww.gsfc.nasa.gov/fuse/>

OBTAIN TECHNICAL INFORMATION ABOUT FUSE ELECTRONICALLY FROM:
http://fuse.pha.jhu.edu/

NASA appreciates your interest and cooperation in participating in the Far Ultraviolet Spectroscopic Explorer Guest Investigator Program.

Anne L. Kinney
Science Program Director
Astronomical Search for Origins
and Planetary Systems

APPENDICES

A. FUSE Mission Description

B. Instructions for Responding to NASA Research Announcements for Solicited Basic Research Proposals

C. Additional Information Regarding Proposal Preparation, Submission, Evaluation, Selection, and Implementation

D. FUSE PI Team Cycle 2 Reserved Target List

E. GI Targets Planned for Observation During Cycle 1

F. FUSE Calibration Target List

G. Abstracts for FUSE PI Team Observing Programs

H. Education and Public Outreach Program

FUSE MISSION DESCRIPTION

A.1 Mission Overview

The Far Ultraviolet Spectroscopic Explorer (FUSE) was launched on a NASA Delta II rocket June 24, 1999, from the Cape Canaveral Air Station. FUSE provides high-resolution ($\lambda/\Delta\lambda$ ~20,000) spectroscopy at far ultraviolet (FUV) wavelengths (905-1187 Å). The nominal mission duration is three years. Following launch, the instrument was activated, tested, and calibrated during In-Orbit Checkout (IOC) and Science Verification (SV) periods. Regular science operations began on December 1, 1999. Cycle 1 science observations will last for a 12-month period of mixed Principal Investigator (PI) team and Guest Investigator (GI) observations.

FUSE is a PI-class mission developed in collaboration with the space agencies of Canada and France. The FUSE Principal Investigator, Dr. Warren Moos of Johns Hopkins University (JHU) in Baltimore, Maryland, is responsible to NASA for the mission design, development, and operations. The PI is also responsible for achieving the primary scientific objectives of the mission. Two major scientific programs have been identified as critical objectives to be carried out by the PI team:

a) Determine the abundance of deuterium in a variety of astrophysical environments, from the local interstellar medium to distant gas clouds along the lines of sight toward quasars and active galactic nuclei. The measurements will determine the extent to which stellar processing has modified the primordial abundance of deuterium, thereby providing a better understanding of the amount produced in the Big Bang and the subsequent chemical evolution of the universe.

b) Measure the amount, distribution, kinematics, and other properties of the O VI ion in the Milky Way disk and halo and in the Magellanic Clouds in order to understand the origin and dynamics of hot gas in these galaxies.

These large programs comprise a large fraction of the total time allocated to the PI team.

The FUSE PI team is conducting other complementary scientific programs. The list of PI team reserved targets is included as Appendix D. Appendix G contains the abstracts for the PI team scientific programs. GI observations of reserved targets will not generally be allowed. The policies regarding target duplication can be found in Section C.3.2.

The spectral window covered by FUSE permits the study of many astrophysically important atoms, ions, and molecules that cannot otherwise be investigated. This wavelength range is extremely rich in spectral lines arising within the interstellar gas. Proposers are encouraged to take full advantage of the capabilities of FUSE to address important problems in astrophysics. The FUV spectral range provides an opportunity for unique studies of many types of astrophysical objects, such as Active Galactic Nuclei (AGN's) and quasars, massive stars, supernova remnants, nebulae, the outer atmospheres of cool stars, planets and their satellites, and comets.

Responding to this NRA constitutes Phase 1 of the FUSE GI proposal process. Information submitted during Phase 1 includes the scientific justification, observation descriptions, astronomical target data, exposure times, and any special requirements (e.g., orientation constraints, timing considerations, etc.). After selection by NASA, successful GI's must submit Phase 2 information to the FUSE Science Center at JHU so that detailed planning, feasibility assessment, and observation scheduling can be performed. Certain key information for Phase 1 and Phase 2 must be submitted electronically, as specified in Appendix C.

A.2 Instrument Overview

FUSE obtains spectra in the 905-1187 Å far-UV band with high resolving power ($\lambda/\Delta\lambda$ ~20,000) and high throughput. FUSE has four optical channels, each of which is fed by separate off-axis parabolic mirrors that serve as the primary mirrors for four co-aligned telescopes, all of which simultaneously view the same astronomical field at the same magnification. A Focal Plane Assembly (FPA) is at the focus of each mirror and consists of a flat mirror mounted on a precision two-axis micromotion stage. There are three entrance apertures built into each FPA. The combined effective area of all four channels ranges from ~20 cm^2 to ~70 cm^2, depending on the wavelength.

The high throughput results from the use of an efficient multichannel optical design and reflective coatings optimized for wavelength coverage in the FUSE range. SiC coatings on two channels provide nearly constant reflectivity (~32%) across most of the FUSE range. At longer wavelengths (λ>1000 Å), Al+LiF coatings provide a reflectivity that is roughly twice that of SiC.

For the two LiF channels, light that does not pass through the slits is reflected into a Fine Error Sensor (FES) CCD camera provided by Canada that has a 19 x 19 arcmin field of view. The FES is used for target and guide star acquisition, attitude determination, and precision pointing control. The positions of guide stars in the FES field of view are sent to the spacecraft's attitude control system which provides pointing stability to <0.5 arcsec (1σ).

The slits form the entrance apertures for Rowland spectrographs. The spectrograph gratings disperse and refocus the light onto two 2-dimensional delay-line microchannel plate detectors. The entire wavelength range is simultaneously covered on each detector by combining data from two optical channels. Two of the optical channels (one LiF and one SiC) feed one detector, the other LiF and SiC channels feed the other detector. The channels with SiC-coated optics cover ~905-1100 Å, and the channels having LiF-coated optics cover ~990-1185 Å. High spectral resolution is achieved in the holographic grating design by minimizing aberrations in the dispersion plane. The resulting spectral images are highly astigmatic in the cross-dispersion direction. Spatially resolved spectral data of limited quality is available only at a few specific wavelengths where this astigmatism is minimized.

Further details on the FUSE instrument can be found at the JHU FUSE Science Center web site at <http://fuse.pha.jhu.edu/>. Paper copies of documentation can be obtained from the NASA Project Scientist at the address given in the Cover Letter to this NRA.

A.3 Satellite Operations and Observation Planning

FUSE is in a nearly circular orbit with a mean altitude of 768 km, an orbital inclination of 25°, and an orbital period of ~100 minutes. The plane of the orbit precesses with a period of ~60 days. FUSE is controlled from the FUSE Satellite Control Center located on the campus of Johns Hopkins University in Baltimore, Maryland. Typically, FUSE is in contact with the ground station for 10-12 minutes per orbit for about seven consecutive orbits, followed by eight orbits (~12 hours) with no contact. All FUSE scientific observations are conducted autonomously by the instrument data system.

Beta is the angle between the anti-Sun direction and the telescope boresight, and is restricted to values between 15• and 105• . However, observations will normally be scheduled in the range 30• < *beta* < 85• in order to maintain coalignment of the four spectroscopic channels. Since the channel alignment is sensitive to changes in the instrument’s thermal environment, the *beta* angle constitutes an important scheduling parameter. Observations outside the nominal *beta* angle range (30• - 85•) are possible, but must be carefully planned in advance. See Appendix C (C.1.3 and C.3) for further information.

A.4 Data Processing, Calibration, and Distribution

The scientific data from FUSE observations consist of the FUV spectral data, as well as optical CCD images from the FES. Observers will receive both data sets and related calibration files in FITS format with binary extensions.

While the raw FUV data are two-dimensional, there is little spatial information available along the slit due to astigmatism in the spectrograph. Therefore, the primary product of the calibration process is extracted, calibrated, one-dimensional spectra. The spectral extraction includes full height of the astigmatic spectral image in order to achieve accurate flux levels. Each exposure produces independent SiC and LiF spectra on each of four detector segments (two segments for each FUSE detector) for a total of eight independent spectra.

The FUSE data processing pipeline is designed to correct for several instrumental effects and produce one-dimensional, calibrated, extracted spectra. The data processing system currently being used to calibrate FUSE spectra is described in the FUSE Data Handbook.
(http://fuse.pha.jhu.edu/archive/dhbook.html)

FES images are processed to subtract bias and dark levels, apply a flat-field correction, and apply an approximate flux calibration.

Wavelength calibration maps pixel coordinates into the wavelength domain. The relative wavelength accuracy is presently 10-20 km s^{-1}, depending on the channel. Since there is no onboard calibration lamp, the wavelength calibration is obtained from observations of astronomical sources with numerous interstellar molecular hydrogen and atomic absorption lines to map high-order variations in the wavelength scale.

The FUSE photometric calibration has an absolute accuracy of ~10% and an rms relative uncertainty of no more than 5%. However, the accuracy realized during an observation depends critically on the stability of the target within the aperture of a particular channel. The photometric calibration is defined by observations and models of hot DA white dwarfs.

FUSE data formats are compatible with many readily available astronomical software packages that can be easily adapted by observers according to their preferences for viewing the raw and calibrated data. Many readily available software tools can also be used for the measurement and analysis of the calibrated one-dimensional spectra.

The FUSE data are archived at the Multimission Archive at Space Telescope (MAST). Access procedures for proprietary and public data are similar to those for Hubble Space Telescope data. Only the PI of each GI program (and their designees) can access that program's data during the proprietary period. After the proprietary period, the FUSE data become publicly available. The distribution of FUSE data is made by electronic file transfer from the FUSE archive. Observations of calibration targets (Appendix F) generally have no proprietary period. See Appendix C for additional information about FUSE data rights.

Further details on FUSE science data processing and calibration are given in the FUSE Observer's Guide at the FUSE mission Web site (http://fuse.pha.jhu.edu/support/guide/obsguide.html).

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS
(JANUARY 2000)
NASA Federal Acquisition Regulations (FAR) Supplement (NFS)
Part 1852.235-72
(accessible through URL: http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm)

(a) **General.**

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRA's contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRA's.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRA's are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRA's; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) **NRA-Specific Items.** Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRA's will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) **Transmittal Letter or Prefatory Material.**

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;

(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;

(vi) Identification of the NRA, by number and title, to which the proposal is responding;

(vii) Dollar amount requested, desired starting date, and duration of project;

(viii) Date of submission; and

(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) **Restriction on Use and Disclosure of Proposal Information.** Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice
Restriction on Use and Disclosure of Proposal Information

The information (data) contained in *[insert page numbers or other identification]* of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) **Abstract.** Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) **Project Description.**

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) **Management Approach.** For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) **Personnel.** The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) **Facilities and Equipment.**

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) **Proposed Costs (U.S. Proposals Only).**

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

(9) **Security.** Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) **Current Support.** For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) **Special Matters.**

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) **Renewal Proposals.**

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) **Length.** Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) **Joint Proposals.**

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) **Late Proposals.** Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.

(h) **Withdrawal.** Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) **Evaluation Factors.**

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

- (i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.
- (ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.
- (iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.
- (iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) **Evaluation Techniques.** Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) **Selection for Award.**

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l) **Additional Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.**

(1) NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted in the NRA, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(2) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without endorsement if endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.

(4) Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

- (i) An exchange of letters between NASA and the foreign sponsor; or
- (ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

(m) **Cancellation of NRA.** NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

(End of provision)

Additional Information Regarding Proposal Preparation, Submission, Evaluation, Selection, and Implementation

The information contained in Appendix C augments and supersedes Appendix B and applies only to this NRA.

Summary of Changes for Cycle 2

I. Observations will be scheduled in the beta angle range 30 to 85 unless there is strong technical or scientific justification for doing otherwise. The technical limit on the beta angle range is 15 to 105, but the more restrictive range is necessary to maintain optical channel alignment and full wavelength coverage. See Sections C.1.3a and C.1.3b.

J. The large aperture (LWRS, 30 x 30 arcsec) is the default aperture. The smaller apertures may be used under certain conditions and restrictions. See Section C.1.3c

K. An observing program's time allocation is charged 4 ksec for each short exposure (t 4 ksec). (In Cycle 1 this was 2 ksec). See Section C.1.2

L. The maximum count rate for Time-Tag mode is 2500 counts per second (formerly was 1200 counts per second). See the FUSE Observers' Guide.

M. FUSE observations that are to be obtained in coordination with other telescopes or facilities must be identified as such and fully justified in the proposal. A limited number of FUSE observations that require coordination with other facilities may be approved for Cycle 2. See Section C.1.3f.

N. A limited number of Target of Opportunity programs may be approved for Cycle 2. See Section C.1.5

C.1 Guest Investigator (GI) Program Description

C.1.1 Overview

Under this NRA, NASA seeks a scientifically meritorious GI program for Cycle 2 of the FUSE mission. GI observing programs should exploit the unique capabilities of FUSE, but the content and scope of GI programs must be consistent with the mission capabilities and observing program policies and guidelines discussed below.

NASA has allocated approximately half of the mission's observing time (over three years) to the GI program and half to the FUSE PI team with which they will address certain high-priority scientific problems described in Appendix A. About one third of the available FUSE observing time in Cycle 1 was allocated to GI programs. GI programs will receive about one half of the available time in Cycle 2 and about two thirds in Cycle 3. FUSE observing time is made available to the international astronomical community through peer-reviewed proposals.

FUSE was launched on June 24, 1999, and went through an extensive In-Orbit Checkout (IOC) and Science Verification (SV) phase during the next several months. Cycle 1 is the 12-month period from December 1999 through November 2000. NASA anticipates that Cycle 2 will run from December 2000 through November 2001, and that Cycle 3 will run from December 2001 through November 2002.

The IOC and SV programs have shown that FUSE meets most prelaunch performance requirements. The FUV sensitivity, background levels, FUV scattered light, and satellite pointing accuracy are close to or are better than predictions. At the present time, the instrument focus and spectral resolution are very close to mission requirements and are still being optimized. There are, however, several areas where in-orbit performance differs from prelaunch expectations. Section C.1.3 describes some important capabilities and constraints that affect how GI programs will be evaluated and implemented in Cycle 2.

There are two types of unscheduled observing time that can be made available with the approval of the FUSE Project Scientist. The first deals with major Targets of Opportunity (ToO), such as supernovae, novae, and comets (see Section C.1.5). The second type, called Project Scientist's Discretionary Observing Time, is intended for observations of an urgent nature requiring a small amount of observing time and are of sufficiently high scientific priority that the observation should not be delayed to the next observing cycle (see Section C.1.6).

Experience with previous far ultraviolet space missions indicates that the sensitivity of FUSE may decline significantly with time, possibly due to exposure to the space environment or from contamination produced by outgassing from the satellite itself. Any sensitivity degradation would most adversely affect the scientific objectives for faint objects, whereas programs to study bright objects should still be feasible in subsequent observing cycles, even if instrument throughput is lower than expected. Therefore, NASA envisions that some priority may be given to observations of faint objects in Cycle 2 in order to take advantage of the higher instrument sensitivity during the early phase of the mission. Proposers who expect to observe very faint targets should read the discussion in Section C.1.3g regarding the fundamental limitations on FUSE's sensitivity.

Procedures and requirements for preparing Cycle 2 GI proposals are described in Section C.2

The targets reserved for the FUSE PI team in Cycle 2 are listed in Appendix D, and the abstracts of the PI team's observing programs may be found in Appendix G. There are no protected science investigations, only reserved targets. The scientific goals of GI proposals may overlap with those of the FUSE PI team so long as different targets are observed. The policies concerning FUSE targets are summarized in Section C.3.

C.1.2 Observing Time Allocation

FUSE observing time in Cycle 2 will be allocated in on-target exposure time in kiloseconds. Proposals should request only the time needed for scientific exposures. After setting aside time for instrument calibration, target acquisition, satellite maneuvering, and operational overhead, NASA anticipates that ~3600 ksec of on-target exposure time will be allocated to GI programs in Cycle 2. NASA will convene a single scientific peer review to make recommendations on all Cycle 2 GI proposals.

NASA envisions that about half of the time allocated to GI's in Cycle 2 will be for large observing programs that require total on-target exposure times of at least 80 ksec. This goal is driven by the desire to have important, comprehensive observing programs undertaken and completed during Cycle 2. It also has the operational benefit of constraining the number of small programs.

Due to the difficulties associated with administering many very small programs, **each Cycle 2 FUSE GI proposal must request a minimum of 10 ksec of on-target exposure time**. If the proposal has only one target, the exposure time on that object must be at least 10 ksec. A proposal having multiple targets can have exposure times of less than 10 ksec per target, as long as the total exposure time for the proposal is at least 10 ksec. **An observing program’s time allocation will be charged 4 ksec for each short exposure.** If a target has an exposure time less than 4 ksec, the program will be charged 4 ksec for that observation to account for the extra overhead associated with short-duration observations. The FUSE mission planning system was designed to support a pool of observations that requires no more than three pointing maneuvers per day, on average.

Proposers may only request observations to be executed during the nominal 12-month period of Cycle 2 (i.e., multicycle proposals will not be accepted). If proposers want to continue their scientific programs over multiple cycles, they must repropose their investigations in subsequent cycles.

NASA intends that all approved regular (i.e., non-ToO) observing programs will be executed. If necessary, regular observing programs will be carried over into Cycle 3 if they are not executed during the current NRA period. GI's need not repropose for these observations. Any such programs will be given priority for execution in Cycle 3. However, ToO programs will not be carried over into Cycle 3. GI's must repropose any ToO programs that are not activated and executed within the nominal one-year observing cycle.

C.1.3 Mission Capabilities and Constraints During Cycle 2

Several important factors bearing on the design of Cycle 2 observing programs are summarized in this section. Complete details are available from the FUSE Observers' Guide, available online at http://fuse.pha.jhu.edu/support/guide/obsguide.html.

FUSE was designed to deliver capabilities for a wide range of observing programs. However, the mission design and performance in orbit have been optimized for absorption spectroscopy of isolated point sources. GI and PI team observations that desire more sophisticated capabilities (e.g., blind offsets, crowded fields, moving targets, the highest possible spectral resolution, signal-to-noise ratio, etc.) will be attempted as experience and resources permit. This section summarizes mission capabilities and constraints for GI observing programs in Cycle 2. Proposers must keep these limitations in mind when developing their scientific objectives and designing their observing programs.

a) *Channel Coalignment* – The relative alignment of the four optical channels is sensitive to changes in the satellite's thermal environment in orbit. In particular, significant changes in the orientation of FUSE with respect to the Sun can cause the channel alignment to drift relative to one another. This effect can be large enough that the target being observed could drift outside even the large aperture during an observation (see below). This is particularly a concern for the SiC channels, as they are located on the side of the satellite that faces the Sun. Channel coalignment is maintained operationally by managing changes in *beta* and other procedures.

b) *Satellite Orientation* - The solar orientation of the satellite is restricted to beta angles between 15 and 105. (*Beta* is the angle between the anti-Sun direction and the telescope boresight.) However, **observations will normally be scheduled in the range 30 < *beta* < 85•** in order to maintain coalignment of the four spectroscopic channels. Since the channel coalignment is sensitive to changes in the instrument's thermal environment, the *beta* angle constitutes an important scheduling parameter. Observations may be scheduled outside the preferred *beta* angle range with strong scientific or technical justification. Such observations must be carefully planned in advance and may have more restrictive scheduling windows.

c) *Spectrograph Apertures* - **The default spectrograph aperture is the LWRS** (see Table C-1), which should be suitable for the vast majority of observing programs. The spectral resolution for point sources observed in the LWRS aperture is limited by the spectrograph focus, optical aberrations, and image motion, and not by the FUV image quality or satellite pointing stability. For the LiF channels, the spectral resolution achieved for a point source observed in the LWRS aperture is essentially identical to that achieved when observing the source through the MDRS aperture (currently ~20,000). The spectral resolution could be somewhat lower in the SiC channels. The photometric accuracy is likely to be better in the LWRS aperture as well.

Proposals must provide scientific justification for the use of the MDRS and HIRS apertures. Legitimate reasons to use these apertures include: (a) to reduce spectral contamination from terrestrial airglow, (b) to reduce spectral contamination from diffuse nebular emission near the target, (c) to eliminate spectral contamination from FUV-bright objects close to the target (e.g., crowded fields), and (d) to achieve higher spectral resolution when observing diffuse targets.

Although the operational constraints are still being characterized, observations that use the MDRS aperture are likely to have more restrictive scheduling constraints than observations made through the LWRS aperture. In addition, the acquisition of SiC data may be more difficult than the acquisition of LiF data when using the MDRS aperture, so **proposers should discuss the relative priority of the SiC and LiF data when the MDRS aperture is requested**. Programs whose scientific objectives depend on the successful acquisition of high-quality SiC data taken through the MDRS aperture will likely have tighter scheduling constraints than for other programs.

Use of the HIRS aperture is restricted to the LiF1 channel during Cycle 2, and the scientific justification for using this aperture must be clearly discussed in the proposal.

Table C-1: FUSE Aperture Sizes, Throughput and Spectral Resolution

Aperture	Acronym	Dimensions (arcsec)	Point Source Throughput[1]	Spectral Resolution ($\lambda/\Delta\lambda$)
Large Square (default aperture)	LWRS	30 x 30	1.00	~20,000 (point source) 3,000 (diffuse source)
Medium Slit	MDRS	4 x 20	0.98	~20,000 (point source)
Narrow Slit	HIRS	1.25 x 20	0.85 (LiF1)	• 20,000 (point source)

[1] Target centered in aperture, no pointing jitter.

d) *Instrument Performance* - The instrument performance described in this NRA will be used by the review panels in their evaluation of Cycle 2 GI proposals. The FUSE instrument is still being calibrated and its performance optimized. Any significant changes will be announced in messages posted on the FUSE web site and in E-mail sent to observers. The FUSE instrument is presently capable of obtaining data with a spectral resolving power of $\lambda/\Delta\lambda$ ~20,000 and a S/N ratio of ~30:1 in a 0.05 Å resolution element over most of the wavelength range.

e) *Exposure Times and Channel Selection* - Because the FUSE spectral resolution varies with wavelength and from channel to channel at a given wavelength, it may not always be possible to combine data from different channels and maintain the desired spectral resolution. Proposers should consider whether to define their exposure times based on achieving a desired S/N ratio in a single channel if the spectral resolution requirements exceed $\lambda/\Delta\lambda$ ~10,000. This, in effect, reduces the effective area of the instrument, but ensures that there are adequate counts to meet the resolution and S/N requirements.

f) *Coordinated Observations* – FUSE observations made in coordination with other telescopes and facilities can provide benefits to certain programs. However, such programs have become increasingly difficult to accommodate due to other FUSE scheduling constraints. Proposers are expected to identify any FUSE observations that may potentially be coordinated with other satellites or ground-based telescopes. The peer review panels will be asked to assess the criticality and potential benefits of the coordinated observations to the scientific objectives of the program. NASA intends to approve up to 12 observations for Cycle 2 that require coordination with other facilities and scheduling within one month of the FUSE observation.

Decisions on when FUSE observations will be scheduled will be made only after Phase 2 data for accepted Cycle 2 programs has been submitted and reviewed. The final scheduling decision will be made by the FUSE PI after consulting with the FUSE Project Scientist, taking into account any recommendations of the proposal review panels. Any requests for coordinated observations received after proposal acceptance by NASA, but not identified in the original proposal, will be reviewed by the FUSE Project Scientist. Approval of such late requests for coordinated observations will be made on a case by case basis prior to any scheduling activity by the FUSE Project.

g) *Sensitivity Limit* – Proposers should be aware that the sensitivity limit for FUSE observations is set by the background level, which varies spatially (i.e., with wavelength) and temporally. The observed background rates are so low that characterizing their spatial and temporal variations has been very difficult. This is part of the ongoing calibration of the FUSE instrument. The FUSE Project hopes to determine the background to an accuracy of ~10%, which would imply that a source could be detected at the 3-σ level when its flux is ~30% of the background, and a source could be detected at the 10-σ level when its flux is equal to the background. When the flux from the source is less then the background level, one enters the domain where higher S/N ratios cannot be obtained by increasing the integration time nor by reducing the resolution, since the S/N is limited by the uncertainty in the background and not

h) the Poisson noise of the source. Proposers who expect to be operating near the sensitivity limit of FUSE (F_{λ} 3×10^{-15} erg cm^{-2} s^{-1} Å^{-1}) are urged to consult the FUSE Observer's Guide for further discussion of this issue (http://fuse.pha.jhu.edu/support/guide/obsguide.html).

i) *Data Processing and Calibration* - The FUSE data processing pipeline is designed to remove and/or flag low quality or unreliable data, correct for electronic drifts and geometrical distortions of the analog detector pixels, correct for the Doppler motion of the spacecraft, straighten the curvature of the astigmatic spectral image, subtract background and apply a flat-field correction, extract the one dimensional spectra, and apply wavelength and flux calibrations to the extracted spectra. However, some of these steps (e.g. astigmatism and flat fielding) are not currently being applied because the appropriate calibrations and procedures have not yet been determined for flight data or the necessary in-flight calibration data are not yet available. A complete description of the data processing system may be found in the FUSE Data Handbook (http://fuse.pha.jhu.edu/archive/dhbook.html).

C.1.4 Data Rights and Distribution

Data rights for FUSE GI observations will reside solely with each observing program's Principal Investigator for a period of six months following delivery of the processed data to the FUSE data archive (http://archive.stsci.edu/fuse). GI's will be notified electronically when their data is available from the archive. After this period, the data become available for public access through the FUSE data archive.

Observations of calibration targets (Appendix F) will be released through the FUSE archive as soon as the processed data products are available. If a calibration target listed in Appendix F is also a PI or GI target, the FUSE Project Scientist will consult with the observer to determine the most appropriate release date. The calibration target list may be modified prior to the release of the NRA for future observing cycles. The FUSE Project may use any FUSE observation to assist in assessing the performance of the instrument, but the confidentiality of data obtained for PI or GI scientific programs will be maintained.

C.1.5 Proposals for Targets of Opportunity

Proposals for major Targets of Opportunity (ToO), such as supernovae, novae, cataclysmic variables in outburst, and comets, etc., will be supported in Cycle 2. Scientists wishing to observe such targets should prepare and submit proposals according to the same procedures used for regular program (i.e., as described in the following sections of this Appendix). Note that a proposal must not contain a mixture of ToO targets and non-ToO targets. Target of Opportunity status should be noted in the Special Requirements section of the proposal. The proposals will be reviewed in the regular review cycle, and successful proposals will be approved but will not be allocated specific amounts of observing time. (However, the review panels may recommend a

maximum amount of observing time that should be allocated to a given ToO program.) Up to four ToO programs requiring a response time of one month or less will be approved for Cycle 2.
The lack of real-time observing capability constrains the speed with which a ToO observation can be implemented. The FUSE ToO response time may be as short as two days. ToO proposals must clearly state the required response time. It will be the GI's responsibility to notify the FUSE Project Scientist and the FUSE Science Center at JHU when any approved opportunity has occurred. The Project Scientist will consult with the GI, the FUSE PI, and other members of the FUSE Project to determine the feasibility of observing the particular event and the impact of disrupting ongoing observations before deciding whether or not to activate the ToO program and approve the observation.

C.1.6 Discretionary Observing Time

Project Scientist's Discretionary Observing Time is intended for observations of an urgent nature for which no approved observing program exists, can be accomplished with a small amount of observing time, and are of sufficiently high scientific merit and priority that they should not be delayed to the next observing cycle. The total amount of Discretionary Observing Time available during Cycle 2 is extremely limited. The FUSE Project Scientist may approve Discretionary Observing Time in those cases where the scientific timeliness of the project is such that it should be done quickly, the need for the observation could not have been foreseen and proposed for in the current observing cycle, and the observation does not duplicate or infringe on approved GI or PI team programs. A proposal for Discretionary Observing Time may be submitted to the Project Scientist in the form of a letter (printed or electronic) and should describe the observations and their feasibility and scientific objectives and explain why Discretionary Time should be granted in lieu of consideration during the next proposal cycle. All requests for Discretionary Time will be reviewed for scientific merit and technical feasibility.

C.1.7 FUSE Observers Advisory Committee

The FUSE Observer's Advisory Committee (FOAC) was formed by the FUSE Project Scientist in the spring of 1999. Membership of the FOAC is drawn from the names of Principal Investigators of GI programs. The FOAC meets periodically to advise the Project Scientist on matters concerning the FUSE GI program. See the FUSE GI program Web site **(**http://fusewww.gsfc.nasa.gov/fuse/**)** for the current FOAC membership and minutes of the FOAC meetings.

C.2 Proposal Preparation

C.2.1 General Guidelines

Proposers should submit a Notice of Intent to Propose (see the NRA cover letter and Section C.6) in order to facilitate the timely selection of peer review panels. Note that Notices of Intent are not required in order to propose for the FUSE GI program. Proposals may be submitted at any time before the proposal due date. Late proposals will be held for the next review cycle at the discretion of NASA. Proposals submitted in response to this NRA should provide the scientific justification and feasibility analysis which form the basis for selection by NASA. Proposers who are awarded observing time, following the evaluation process described in section C.8, will subsequently be required to submit observation specifications following NASA-provided guidelines. These data provides the FUSE Science Center with the detailed definition of each observation to be executed for the program. In addition, selected U.S. proposers will be invited to submit a budget based on guidelines provided by NASA – See Section C.4.

Submission of proposals in response to this NRA has three components: (1) a NASA provided form referred to as “Phase I Proposal Form” must be completed and submitted electronically, (2) the requisite number of printed copies of the complete proposal must be submitted to the address given below, and (3) proposal summary information must be submitted through an online Web page. The Phase 1 Proposal Form is an ASCII LaTeX file that allows the proposer to supply certain information for a set of keywords, including the proposed target list. Some keywords are required (e.g., PI name, total amount of observing time requested) and some are optional (e.g., special requirements). For proposers familiar with LaTeX, the Proposal Form may also be used to format the final printed proposal. Electronic submission of the LaTeX Proposal Form is required of all proposers, since this file will be parsed into a database to support the proposal review. Proposers without access to electronic mail should consult with the FUSE Project Scientist to discuss proposal submission. Since the forms are in ASCII format, proposers can edit the files using the text editor of their choice.

C.2.2 Who May Propose

Participation in the FUSE GI Program is open to all categories of organizations, foreign and domestic, including industry, educational institutions, NASA Centers, nonprofit organizations, and other Government agencies. Each FUSE GI proposal must identify a single Principal Investigator (PI) who assumes full responsibility for the conduct of the scientific investigation.

Following selection by NASA, the FUSE Science Center at JHU will communicate formally only with the PI of each program, or his/her designee. It is this person's responsibility to provide JHU with the Phase 2 data defining each exposure in a timely manner and to respond to any questions concerning observational constraints or configurations.

C.2.3 Canadian and French Observing Time

As part of their participation in and contribution to the FUSE mission, Canada and France each receive a minimum of 5% of the mission's observing time as defined in Letters of Agreement between NASA and the respective space agencies. Most of this time will be selected competitively via the GI proposal peer review process described in this NRA. Scientists at Canadian and French institutions should follow the instructions in this Appendix for proposal preparation and submission. Note, however, that an institutional endorsement of the type described in the following section is not required for Canadian and French proposals submitted in response to this NRA.

C.2.4 Guidelines for Other non-U.S. Participation

See Section (l) of Appendix B.

C.2.5 Proposal Format and Content

The Phase 1 Proposal Form defines a number of sections, or subject areas, including the target list and exposure times, that must be addressed in each proposal. These sections are listed below and should be presented in the proposal in the order indicated (provided automatically by the Proposal Form). Proposals must be concisely written. The length of each section of the proposal should not exceed the page limits indicated below, using single-spaced pages 8.5" (21.6 cm) by 11" (27.9 cm) or A4 format paper with 1" (2.5 cm) margins. Proposals must be printed with a font size no smaller than 11 points or about 16 characters per inch.

Instructions for obtaining the Proposal Form are given in Section C.5. Submission procedures are described in Section C.7.

Reviewers will be instructed to base their review on only the portion of each proposal that complies with the page limits given in this NRA.

The Cover Sheet of the proposal must provide the:

a) Proposal title
b) PI name, institution, mailing address, telephone and facsimile number, and electronic mail address
c) Total requested exposure time in kiloseconds
d) Total number of targets
e) Scientific category (see below)
f) Abstract - a brief descriptive summary of the proposal (200 words or less). Note that the abstracts of successful proposals will be made available online, so they should not contain proprietary or confidential information.

Either the Cover Sheet or the second page of the proposal must list the following information for each Co-Investigator (Co-I):

j) Name, institution, country

Note that this "cover sheet" is distinct from the "cover page/proposal summary form" referred to in the cover letter of this NRA.

Scientific Category - Each proposal must identify one of nine primary research areas. The scientific category assigned by the proposer will guide assignment of the proposal to the appropriate scientific review panel. The nine research areas (and some examples) are:

1. Solar system objects (planets, satellites, comets)
2. Cool stars (single and noninteracting binary systems)
3. Hot stars (O, B, and Wolf-Rayet stars, white dwarfs, central stars of planetary nebulae, including hot stars in the Magellanic Clouds)
4. Interacting binary systems (RS CVn systems, cataclysmic variables, symbiotic stars, mass-transfer binaries, novae)
5. Stellar ejecta and gaseous nebulae (circumstellar material, H II regions, planetary nebulae, supernova remnants, supernovae)
6. Interstellar medium and galactic structure: (interstellar gas and dust, diffuse Galactic emission, Galactic halo, gas and dust in the Magellanic Clouds)
7. Galaxies and extragalactic stellar populations (excluding the Magellanic Clouds)
8. AGN and quasars
9. QSO absorption lines and the intergalactic medium

Proposal Sections - The proposal must contain the following sections and be addressed in the order indicated for each proposed observing program. The page length limits are indicated.

1. *Scientific Justification* (three pages) - Fully describe the scientific objectives of the proposed investigation, clearly stating its goals, its significance to astronomy, and why FUSE data are essential to the investigation. All text, figures, tables, and references must be included within this three-page limit.

2. *Feasibility and Safety* (two pages) - The proposed program must justify the need for the requested exposure time for each target, noting the required signal-to-noise ratio (S/N) and spectral resolution, expected flux and any other information relevant to the observation (e.g., wavelength region of interest, spectral flux distribution, emission line intensities). This section forms the basis for technical assessment of the feasibility of the proposed observations. Describe the basis for and accuracy of your flux estimates, including any extrapolations into the FUSE spectral range that have been made.

3. *Description of Observations* (one page) - Describe the observations. All special requirements (e.g., MDRS or HIRS aperture, Target of Opportunity, monitoring program, specific aperture

orientation) must be summarized and justified. These encompass any information affecting the scheduling of the target, such as pointing constraints (e.g., spacecraft roll, time constraints), scheduling constraints (e.g., coordinated observations, phase coverage, contiguous observations), Targets of Opportunity, and moving targets. Ephemeris data for solar system targets is not required in the Phase 1 proposal.

4. *Additional Information* (one page) - This section may be used to provide any relevant information concerning data analysis plans, modeling capabilities, plans for supporting observations to be conducted using other telescopes, etc.

5. *Principal Investigator and Co-Investigator Biographical and Publication Data* (one page) - An abbreviated biographical sketch for the PI should be provided and include a list of the most recent refereed publications relevant to the scientific proposal. Additional biographical or publication data may be provided for any of the Co-I's the PI wishes to include. All material must fit within the one-page limit.

6. *(Optional) Education/Public Outreach Proposal*

Proposed Target List - Each proposal must include a table of the proposed targets for observation. This table should include all the requested target and exposure information and parameters described in the instructions for the Phase 1 Proposal Form. Proposers are strongly encouraged to use the LaTeX Proposal Form to prepare this formatted table of targets and exposure times. In all cases, these data must also be submitted electronically using the FUSE LaTeX Proposal Form.

C.3 Targets For Observation

This NRA primarily seeks to identify new targets for observation with the FUSE satellite. Appendix D lists the targets reserved by the PI team for Cycle 2. In order to provide for the needs of both the PI team and GI programs, the PI team may reserve any given target for a maximum of two cycles. A target reserved for Cycles 1 and 2 may not also be reserved for Cycle 3 without the approval of NASA. Most of the targets listed in Appendix D for Cycle 2 are also Cycle 1 targets. This policy allows the PI team to design the large observing programs outlined in Appendix A, but does not lock up individual targets for the entire three-year mission. The PI team will have an opportunity to update its reserved target list before the NRA for Cycle 3 is issued.

C.3.1 Detector Performance Constraints

Given the sensitivity of the FUSE instrument, bright targets in the far ultraviolet present a particular challenge to the mission. Sufficiently high local count rates may damage the microchannel plates. It is, therefore, necessary to restrict observations of UV-bright targets.

A detailed description of the bright limit can be found in the FUSE Observer's Guide. The FUSE Project will not support Cycle 2 observations of targets that have a flux greater than 1.0×10^{-10} ergs cm^{-2} s^{-1} $Å^{-1}$ at any wavelength in the 900-1200 Å band. The bright limit will be reevaluated as the mission progresses, based on in-orbit performance, estimates of the charge remaining in the microchannel plates, and the availability of new observing modes. Changes in the bright limit will be posted at the JHU FUSE Science Center web site < http://fuse.pha.jhu.edu/ >.

GI's will be required to demonstrate that their proposed targets do not exceed the bright limit. For sources with poorly determined FUV fluxes, or sources with a flux greater than 1.0 x 10^{-11} ergs cm^{-2} s^{-1} $Å^{-1}$, an initial "snapshot" observation to verify the source flux may be required. Any "snapshot" exposures will be charged against the allocated observing time for that program, and GI proposals should include this time in their time request. **Keep in mind that 4 ksec is charged to the proposal's time allocation for each short exposure.** Exposure times and flux determinations for bright objects must comply with the policies outlined in the FUSE Observer's Guide.

Emission line objects must adhere to the same bright limit as continuum sources. That is, the peak flux cannot exceed 1.0 x 10^{-10} ergs cm^{-2} s^{-1} $Å^{-1}$. For an unresolved emission line (e.g., a Gaussian line with FWHM ~0.05 Å, which corresponds to a velocity width of ~15 km s^{-1}), this means that the line-integrated flux cannot exceed ~5.0 x 10^{-12} ergs cm^{-2} s^{-1} per 0.05 Å resolution element. The allowable line-integrated flux scales linearly with the line width for fully-resolved emission lines.

Based on current estimates of the fixed pattern noise in the detectors, the FUSE Project estimates that signal-to-noise (S/N) ratios of 30:1 are routinely achievable over most of the spectral coverage. Achieving higher S/N spectra with FUSE may be possible, but its feasibility has not been demonstrated, since the characteristics and stability of the in-orbit flat-field calibration have not been determined. During Cycle 2, the FUSE Project plans to limit the number of GI and PI team observations requiring S/N > 30:1. Proposed observations with S/N ratios greater than 30:1 require ample justification for the need for higher S/N and should bear in mind that such performance may not be achievable.

Proposers should be aware that the sensitivity limit for FUSE observations is set by the background level, which varies spatially (i.e., with wavelength) and temporally. The observed background rates are so low that characterizing their spatial and temporal variations has been very difficult. This is part of the ongoing calibration of the FUSE instrument. The FUSE Project hopes to determine the background to an accuracy of ~10%, which would imply that a source could be detected at the 3-σ level when its flux is ~30% of the background, and a source could be detected at the 10-σ level when its flux is equal to the background. When the flux from the source is less then the background level, one enters the domain where higher S/N ratios cannot be obtained by increasing the integration time nor by reducing the resolution, since the S/N is limited by the uncertainty in the background and not the Poisson noise of the source. Proposers who expect to be operating near the sensitivity limit of FUSE (F_λ 3x10^{-15} erg cm^{-2} s^{-1} $Å^{-1}$) are urged to consult the FUSE Observer's Guide for further discussion of this issue.
(http://fuse.pha.jhu.edu/support/guide/obsguide.html)

C.3.2 Target Duplication

This NRA primarily seeks to identify new targets for observation with the FUSE satellite. Appendix D lists the targets reserved by the PI team for Cycle 2. Cycle 2 GI targets should not overlap with those on the PI team reserved target list. Proposers should bear in mind that the FUSE instrument has essentially only one observational mode. Aside from small differences resulting from the choice of aperture, the exposure time alone defines the achievable signal-to-noise ratio for a given spectral resolution for observations of point sources. The target's name and celestial coordinates (RA & DEC in epoch J2000) will be considered when judging any potential target duplications.

Some PI Team programs have targets whose exposure times cannot be specified in advance because they are part of a pool that will first be observed with relatively short duration exposures to determine their suitability for more detailed, long duration follow-up exposures. In these cases, the exposure times listed in Appendix D may not accurately reflect how much time the PI Team ultimately spends on the target.

Proposers should also consult the list of observations planned for Cycle 1 GI programs available as Appendix E. Any duplication of targets between Cycle 1 and Cycle 2 GI programs must be strongly justified in the proposal. The Cycle 2 review panels will receive a summary of any duplication between Cycle 1 targets and those proposed for Cycle 2. The panels will also receive a summary of target duplications between different Cycle 2 proposals. In general, a given target will be allocated to only one observing program.

C.3.3 Target List Modifications

After selection of Cycle 2 GI programs, additional GI and PI team targets may be added with the approval of the FUSE Project Scientist. Any new target must be consistent with the program's scientific objectives and must not already be allocated to another program.

C.3.4 Solar System Targets and Targets of Opportunity

Since solar system objects are not defined uniquely by a fixed RA and DEC, a different policy applies with regard to protecting the solar system observations planned by the PI team. A GI may propose to observe a solar system target, even if it has been reserved by the PI team, if the proposed observation and scientific investigation does not infringe on that planned by the PI team. The criteria used to differentiate the proposed GI observations from those of the PI team are the scientific goals and other factors, including aperture size, aperture location on the target, required resolving power, and integration time. GI proposals for reserved solar system targets should clearly state the differences between the proposed observation and those of the PI team. The PI team solar system observations are those described in the abstracts included in Appendix G (Program ID's P109, P120, and P180).

Proposers should be aware that only a limited number of moving target observations may be attempted during Cycle 2. Moving targets require special commanding and flight and ground software. These observing modes have not been tested at the present time. They require a high degree of familiarity on the part of the user with the FUSE satellite capabilities, as well as intensive coordination with the operations team. The FUSE Project will attempt to implement a small number of Cycle 2 GI observations of solar system targets, if selected by NASA following the Cycle 2 peer review. The more demands on mission capabilities and resources required by a moving target observation, the less likely it is to be implemented in Cycle 2.

Any solar system observations attempted with FUSE during Cycle 2 must adhere to the beta angle constraints discussed in C.1.3.

Some Targets of Opportunity fall into the same category as solar system objects because their identity and RA & DEC are not know in advance. In this case, the scientific investigation defined by the PI team will take precedence over a GI proposal with similar objectives. There is only one PI team program in this category (P123 – See Appendix G)

C.3.5 Calibration Targets

Appendix F contains the current list of potential FUSE calibration targets. Astronomical targets are needed for photometric, flat-field, and wavelength calibration. Some, but probably not all, of these objects will be observed for calibration purposes. GI's are allowed to include calibration targets as scientific targets in their programs, provided those targets are not also on the PI team target list (see the discussion of FUSE data rights in Section C.1.4). The FUSE Project may continue to use these objects for calibration, even if the target is allocated to a GI or PI team program. Several of these calibration targets already appear on the PI team reserved target list.

C.4 Funding for U.S. Investigators

Limited funds for awards under this NRA are expected to be available to investigators at U.S. institutions subject to the annual NASA budget cycle. Budgets should not be submitted with FUSE proposals submitted in response to this NRA. Successful proposers at U.S. institutions, including U.S. Co-Investigators on successful non-U.S. proposals, will be eligible for funding. These investigators will receive a funding guideline from NASA based on the scope of the approved observing program and the available budget for the FUSE Cycle 2 GI program. An institutional signature will be required when a budget is submitted.

C.5 Obtaining the Phase 1 Proposal Form and Instructions

The Phase 1 LaTeX Proposal Form and style file may be retrieved automatically via E-mail by sending a message to <fuseprop@fusewww.gsfc.nasa.gov> with the word "help" as the subject of the message. The necessary files will automatically be sent by E-mail. These files, plus the instructions for preparing the Proposal Form, are also available electronically from the FUSE Guest Investigator Program Web site (http://fusewww.gsfc.nasa.gov/fuse/).

C.6 Notices of Intent to Propose

In order to expedite the proposal review process and the timely selection of scientific peer review panels, investigators intending to submit proposals for participation in this program should notify NASA by the date given in the letter of solicitation to this NRA. This Notice of Intent, containing the tentative title of the investigation, name and affiliation of the PI and any Co-I's, and a brief summary of the objectives of the proposed investigation, should be submitted online using a Web form at <http://props.oss.hq.nasa.gov>.

C.7 Proposal Submission

Each proposer must submit (1) a completed LaTeX Proposal Form, (2) proposal summary information (proposal title, PI and Co-I names and institutions, and scientific category) through an on-line web form, and (3) 12 printed copies of the proposal. Electronic submission of the LaTeX Proposal Form is required of all proposers.

1. Send the LaTeX Proposal Form to: <fuseprop@fusewww.gsfc.nasa.gov>
   An acknowledgment of receipt will be sent to the proposal submitter
   by return E-mail.

2. Provide basic proposal information through a web form at <http://props.oss.hq.nasa.gov>
   (Note: do not fill in Budget Summary information)

3. Send 12 printed copies of the proposal to:

   FUSE Guest Investigator Program
   NASA Peer Review Services
   Suite 200
   500 E Street SW
   National Aeronautics and Space Administration
   Washington, DC 20024-2760
   USA

All proposal material must arrive at the above address by the closing date given in the Cover Letter to this NRA and the beginning of this Appendix in order to be included in the Cycle 2 proposal review.

C.8 Evaluation and Selection Process

All proposals submitted in response to this NRA by its deadline will be reviewed for scientific merit and for technical feasibility. Proposals will be evaluated in a competitive peer review conducted by NASA Headquarters. The peer review will be carried out by panels organized by research area. The panel membership will include scientists from the U.S., Canada, and France. Upon completion of the review by the individual panels, a final cross-discipline panel review chaired by a NASA HQ representative will synthesize the results of the individual panels. Based on these results, the FUSE Program Scientist will then develop a recommendation for the total program to be submitted to the Selection Official.

The final proposal selection will be made by the Director, Research Program Management Division, Office of Space Science.

The following criteria, listed in descending order of importance and formally amend section (i) of Appendix B, will be used in evaluating Cycle 2 proposals for the FUSE Guest Investigator Program. The weight of the first criteria is approximately the same as the combined weight of the second and third criteria (which are co-equal), and is approximately twice the combined weight of the fourth and fifth criteria (which are co-equal).

1. The overall scientific merit of the proposed investigation;

2. The suitability and feasibility of using the FUSE observatory for the proposed investigation;

3. The feasibility of accomplishing the objectives of the investigation;

4. The data analysis plans; and

5. The competence and relevant experience of the Principal Investigator and any collaborators to carry the investigation to a successful conclusion, including timely publication of the research in peer reviewed journals.

The FUSE Science Center at JHU will provide the scientific review panels with an assessment of the technical feasibility of each GI proposal. After acceptance of an observing program by NASA, successful proposers must prepare detailed observing plans for submission to JHU, and which are required for scheduling purposes. These plans, referred to as “Phase 2” plans, will again be assessed for feasibility. Should there be any question regarding the safety or feasibility of individual observations, the FUSE PI, in consultation with the FUSE Project Scientist, will make the final decision as to whether or not to attempt or postpone a particular observation, based on the latest information available regarding the satellite's on-orbit performance.

C.9 Other Conditions

NASA may select only a portion of a proposer's investigation, in which case the investigator will be given the opportunity to accept or decline such partial acceptance.

C.10 Schedule

The schedule for proposal submission is given in the cover letter. It is the intent of NASA to make an announcement of selections within approximately two months of the proposal submission date.

C.11 For Further Information

Policy questions regarding this NRA and the FUSE GI Program should be addressed to:

Dr. Hashima Hasan
FUSE Program Scientist
Research Program Management Division
Code SR
Office of Space Science
National Aeronautics and Space Administration
Washington, DC 20546-0001
USA

Tel: 202-358-0692, Fax: 202-358-3097
E-mail: hashima.hasan@hq.nasa.gov

Scientific and technical questions about the FUSE Guest Investigator Program and requests for printed copies of documentation mentioned in this NRA should be addressed to:

Dr. George Sonneborn
FUSE Project Scientist
Laboratory for Astronomy and Solar Physics
Code 681
Goddard Space Flight Center
National Aeronautics and Space Administration
Greenbelt, MD 20771
USA

Tel: 301-286-3665 Fax: 301-286-1753
E-mail: george.sonneborn@gsfc.nasa.gov

Questions regarding the technical performance of the FUSE mission should be addressed to:

Dr. B-G Andersson
FUSE Guest Investigator Officer
Department of Physics and Astronomy
Johns Hopkins University
Baltimore, MD 21218
USA

Tel: 410-516-8378, Fax: 410-516-5494
E-mail: fuse_support@pha.jhu.edu

Electronic versions of all appendices are available by anonymous ftp or the World Wide Web (http://fusewww.gsfc.nasa.gov/fuse/ and http://spacescience.nasa.gov/research.htm).

FUSE PI Team Reserved Target List for Cycle 2

This Appendix contains targets reserved for the FUSE PI Team observations in Cycle 2. This is the second year of this two-year target list for program IDs P1nn and Q1nn. New targets have IDs P20n or Q201. The listing is sorted in order of increasing Right Ascension (J2000.0).

The information listed below includes the Program Identification, the target name, J2000 equatorial coordinates, total planned exposure time, V magnitude (when appropriate), and an indicator of the spectral type or general object type. The Program ID permits cross-referencing of a target with its primary science program, as described by the abstract listings in Appendix G.

Prog ID	Target Name	RA (J2000.0)	DEC (J2000.0)	Exposure Time (s)	V	Object Type
P122	HD224868	00 01 21.60	+60 50 22.0	3600	7.27	B0Ib
P101	HD73	00 05 36.80	+43 24 5.0	300	8.48	B1.5IV
P101	MRK335	00 06 19.30	+20 12 9.0	23700	13.90	Syft1
P204	GD 2	00 07 32.3	+33 17 28	8000	13.8	DA
P104	WD0005+511	00 08 17.00	+51 22 54.0	5000	13.32	WD
P119	HD560	00 10 2.00	+11 08 44.0	2000	5.50	B9Vn
Q201	Q0026+1259	00 29 13.8	+13 16 04	20000	14.78	QSO
P184	M31OB78-231	00 40 29.70	+40 44 30.0	4000	18.30	O8
P101	HD3827	00 41 12.10	+39 36 14.0	300	8.01	B0.7V
P104	WD0038+199	00 41 35.00	+20 09 12.0	17000	14.56	WD
P117	HD4004	00 43 28.30	+64 45 44.0	4000	10.54	WN5
P118	HD4128	00 43 34.50	-17 59 13.8	11560	2.04	K0III
P117	AV14	00 46 32.66	-73 06 5.6	2000	13.77	O3-4V
P115	AV15	00 46 42.19	-73 24 54.7	15000	13.20	O7II
P104	BD-12D134	00 47 3.30	-11 52 19.0	800	11.96	CSPN
P117	AV26	00 47 50.07	-73 08 20.7	2000	12.55	O7III
P115	AV47	00 48 51.35	-73 25 57.6	15000	13.38	O8III
P101	JL212	00 49 1.30	-56 05 49.0	2600	10.34	B2
P207	RJ0050+1129	00 49 32.0	+11 28 26	10000	14.3	AGN
P115	AV69	00 50 17.40	-72 53 29.9	15000	13.39	O7III
P115	AV75	00 50 32.50	-72 52 36.2	15000	12.78	O5III
P117	AV83	00 50 52.01	-72 42 14.5	2000	13.38	O7.5I
P115	AV95	00 51 21.54	-72 44 12.9	15000	13.91	O7.5III

Prog ID	Target Name	RA DEC (2000.0)	Exposure Time (s)	V	Object Type
P102	HD5005A	00 52 49.40 +56 37 40.0	3000	7.76	O6.5Vf
P204	GD 659	00 53 17.2 -32 59 58	6000	13.3	DA
P111	IZW1	00 53 34.90 +12 41 36.0	15000	14.40	AGN
P107	PG0052+251	00 54 52.20 +25 25 39.0	2000	15.42	QSO
P101	TONS180	00 57 20.00 -22 22 56.0	27000	14.34	Syft1
P117	AV207	00 58 33.19 -71 55 46.5	2000	14.37	O7V
P117	NGC346-6	00 58 57.74 -72 10 33.6	2000	14.02	O4V((f))
P117	NGC346-4	00 59 0.39 -72 10 37.9	2000	13.66	O5-6V
P117	NGC346-3	00 59 1.09 -72 10 28.2	2000	13.50	O3III(f)
P117	NGC346-1	00 59 4.81 -72 10 24.8	2000	12.57	O4III(f)
P103	SK78	00 59 26.70 -72 09 55.0	4200	11.69	OB+WN3
P103	SK80	00 59 30.00 -72 11 0.0	9500	12.36	O7Iaf+
P117	AV232	00 59 32.19 -72 10 46.2	2000	12.36	O7Iaf+
P103	SK82	00 59 42.00 -72 45 0.0	12700	12.16	B0Iaw
P107	MRK352	00 59 53.30 +31 49 37.0	2000	14.80	Syft1
P117	AV238	00 59 55.61 -72 13 37.7	2000	13.77	O9III
P117	AV243	01 00 6.80 -72 47 19.0	2000	13.87	O6V
P117	AV242	01 00 6.84 -72 13 57.0	2000	12.11	B1Ia
P117	AV264	01 01 7.72 -71 59 58.6	2000	12.36	B2Ia
P115	AV321	01 02 57.04 -72 08 9.3	15000	13.38	O9I
P103	SK108	01 03 8.70 -72 06 11.0	8000	12.37	O6.5n+WN3
P117	AV327	01 03 10.58 -72 02 13.8	2000	13.25	O9II
P117	AV372	01 04 55.73 -72 46 47.7	2000	12.63	O9I
P115	AV378	01 05 9.44 -72 05 35.0	15000	13.88	O9III
P117	AV388	01 05 39.62 -72 29 26.8	2000	14.12	O4V
P117	AV423	01 07 40.43 -72 50 59.6	2000	13.28	O9.5I
Q107	SK143	01 10 55.60 -72 42 54.7	18000	12.88	O9.7Ib
P104	WD0109-264	01 12 11.50 -26 13 28.0	39000	13.15	WD
P117	AV469	01 12 28.96 -72 29 28.8	2000	13.20	O8II
P103	SK159	01 15 48.00 -73 21 0.0	10600	11.89	B0.5Iaw
P117	AV488	01 15 58.84 -73 21 24.1	10000	11.90	B0.5Iaw
P107	TONS210	01 21 51.50 -28 20 57.0	2000	14.70	QSO
P191	MRK357	01 22 40.20 +23 10 10.0	24000	16.00	GAL
P101	FAIRALL9	01 23 45.70 -58 48 22.0	28000	13.23	Syft1
P103	SK188	01 31 6.00 -73 26 0.0	12700	12.88	WO4+O7III
P184	M33FUV444	01 34 9.90 +30 39 11.0	2000	17.70	O6
P204	GD 984	01 34 24.0 -16 07 08	8000	13.9	DA

Prog ID	Target Name	RA DEC (2000.0)	Exposure Time (s) V Object Type
P184	M33OB88-7	01 34 59.40 +30 42 1.0	4000 18.50 O8
P122	HDE232522	01 46 2.10 +55 19 55.0	830 8.67 B1II
P107	MRK1014	01 59 50.20 +00 23 41.0	2000 15.69 Syft1
P102	HD12323	02 02 30.00 +55 37 27.0	1500 8.90 ON9V
P186	HD12230	02 05 5.30 +77 16 55.5	2000 5.27 F0Vn
P101	HD12740	02 06 11.40 +49 09 23.0	500 7.94 B1.5II
P184	TT-ARI	02 06 53.10 +15 17 43.0	2000 10.00 CV
P107	MRK586	02 07 49.80 +02 42 56.0	2000 15.39 QSO
P102	HD13268	02 11 29.60 +56 09 32.0	8400 8.18 ON8V
P107	MRK590	02 14 33.60 -00 46 0.0	2000 13.85 Syft1.2
P102	HD13745	02 15 45.80 +55 59 47.0	7300 7.83 O9.7IIn
P102	HD14434	02 21 52.30 +56 54 18.0	14300 8.49 O5.5Vnfp
P101	HD14633	02 22 54.20 +41 28 49.0	300 7.46 O8.5V
P105	BD+48D658	02 23 23.50 +49 01 56.0	4800 8.78 B1
P102	HD15137	02 27 59.80 +52 32 58.0	1700 7.88 O9.5II-IIIn
P117	HD15558	02 32 42.30 +61 27 22.0	300 7.86 O5IIIf
P102	HD15642	02 32 56.30 +55 19 39.0	4600 8.54 O9.5IIIn
P101	NGC985	02 34 37.30 -08 47 8.0	46600 14.50 Syft
P104	WD0232+035	02 35 6.00 +03 44 0.0	8000 12.25 WD(DA+dM?)
P111	NGC1068	02 42 40.69 -00 00 50.5	18000 11.40 AGN
P104	HD17573	02 49 58.70 +27 15 44.0	2000 3.63 B8Vn
P101	HD18100	02 53 40.70 -26 09 20.0	300 8.46 B1V
P133	K1-26	02 56 58.30 -44 10 19.0	2600 15.40 sdO
P107	MRK609	03 25 25.40 -06 08 38.0	2000 14.50 Syft1.8
P116	HD21483	03 28 46.53 +30 22 31.9	6000 7.06 B3III
P104	HD22049	03 32 59.10 -09 27 31.0	41000 3.73 K2V
P115	NGC1360	03 33 14.74 -25 52 9.5	4500 11.30 sd(O)
P101	HD22586	03 35 37.90 -52 33 24.0	700 8.03 B2III
P153	HR-1099	03 36 47.00 +00 35 24.0	16000 5.70 K1IV
P193	HD23180	03 44 19.04 +32 17 18.3	2000 3.82 B1III
P116	BD+31D643	03 44 34.08 +32 09 46.8	23900 8.51 B5V
P186	HD23628	03 47 23.90 +24 35 22.5	4530 7.66 A4V
P104	HD23850	03 49 9.60 +24 03 15.0	2000 3.63 B8III
P154	V471-TAU	03 50 24.00 +17 14 48.0	36000 9.20 K0
Q201	HD24263	03 52 00.1 +06 32 05	4000 5.69 B5V
P193	HD24534	03 55 22.99 +31 02 45.0	6000 6.10 O9Vpe
P115	NGC1535	04 14 15.72 -12 44 22.0	4500 12.20 sd(O)
P163	T-TAU	04 21 59.40 +19 32 6.5	20000 10.40 TTAU
P119	HD27638	04 22 34.80 +25 37 46.0	4000 5.40 B9V
P116	HD27778	04 23 59.69 +24 18 4.2	5900 6.36 B3V

Prog ID	Target Name	RA DEC (2000.0)	Exposure Time (s)	V	Object Type
P107	3C120	04 33 11.10 +05 21 16.0	2000	14.20	Syft1
P104	HD29139	04 35 55.00 +16 30 43.0	19000	0.85	K5III
P107	MRK618	04 36 22.20 -10 22 34.0	2000	14.50	Syft1
P122	HD29376	04 37 54.30 +07 19 3.0	440	7.02	B3Vsb
P104	WD0439+466	04 43 20.90 +46 42 5.0	7000	12.67	WD
P102	HD30677	04 50 3.60 +08 24 28.0	380	6.84	B1II-IIIn
P103	SK-67D05	04 50 24.00 -67 40 0.0	11000	11.34	O6Iaf+
Q201	HD30122	04 50 51.9 +28 18 51	4000	6.34	B5III
P117	SK-67D14	04 54 31.92 -67 15 24.9	2000	11.52	B1Ia
P103	SK-67D18	04 55 12.00 -67 11 0.0	10400	12.02	O6-7+WN5-6
P117	HD32109	04 55 31.50 -67 30 1.0	2000	13.87	WN4
P119	HD31293	04 55 45.80 +30 33 5.0	18000	7.10	A0pe
P104	WD0455-281	04 57 12.70 -28 08 10.0	31000	13.95	WD
P117	HD32402	04 57 24.19 -68 23 57.2	2000	13.30	WC4
P117	SK-69D52	04 57 48.50 -69 52 22.0	2000	11.50	B2Ia
P103	SK-65D21	05 01 24.00 -65 42 0.0	20900	12.02	O9.5Ia
P103	SK-65D22	05 01 24.00 -65 52 0.0	5200	12.07	O6Iaf+
P135	HD31964	05 01 58.10 +43 49 24.0	30000	3.00	A9Ia
P164	ZETA-AUR	05 02 28.70 +41 04 33.0	2000	3.75	ZAUR
P117	HD33133	05 03 10.20 -66 40 54.0	2000	12.69	WN8
P103	SK-69D59	05 03 12.00 -69 02 0.0	5200	12.13	B0Ia
P204	REJ0503-289	05 03 55.9 -28 54 36	6000	13.9	DO
P117	SK-70D60	05 04 40.94 -70 15 34.5	2000	13.85	O4V
P117	SK-70D69	05 05 18.73 -70 25 49.8	2000	13.90	O4V
P117	SK-68D41	05 05 27.20 -68 10 2.7	2000	12.01	B0.5Ia
P104	G191-B2B	05 05 30.30 +52 49 54.0	5000	11.80	WD
P117	SK-68D52	05 07 16.00 -68 32 5.0	2000	11.70	B0Ia
P184	0513-69	05 13 39.30 -69 32 1.0	2000	16.50	CV
P117	SK-67D69	05 14 20.16 -67 08 3.5	2000	13.09	O3III
P101	AKN120	05 16 11.50 -00 09 1.0	30800	14.60	Syft1
P104	HD34029	05 16 40.90 +46 00 14.0	22000	0.08	G5III+G0III
P122	HD34333	05 18 21.00 +36 37 55.0	870	7.71	B3+B3V
P117	SK-69D104	05 18 59.57 -69 12 54.7	2000	12.10	O6Ib(f)
P103	SK-67D76	05 20 0.00 -67 20 0.0	7400	12.42	B0Ia
P117	SK-65D44	05 20 18.00 -65 24 13.0	2000	13.65	O9V
P101	HD34656	05 20 43.00 +37 26 19.0	300	6.75	O7IIf
P122	HD35215	05 24 28.30 +30 11 32.0	7500	9.41	B1V
P117	SK-69D124	05 25 18.37 -69 03 11.1	2000	12.66	O9Ib
P117	SK-67D101	05 25 56.36 -67 30 28.7	2000	12.63	O9III
P103	SK-67D104	05 26 4.00 -67 29 48.0	9500	11.44	OB+WC5
P103	SK-68D80	05 26 33.00 -68 50 12.0	6900	12.40	WC5+OB

Prog ID	Target Name	RA (2000.0)	DEC (2000.0)	Exposure Time (s)	V	Object Type
P203	SK-68D82	05 26 45.3	-68 49 53	10000	10.0	B1
P117	BI170	05 26 47.79	-69 06 11.7	2000	13.09	O9.5II
P117	SK-67D111	05 26 48.00	-67 29 33.0	2000	12.57	O7Ib(f)
P117	BI173	05 27 10.08	-69 07 56.2	2000	13.00	O8III
P115	IC418	05 27 28.81	-12 41 48.3	4500	0.00	CSPN
P117	SK-70D91	05 27 33.74	-70 36 48.3	2000	12.78	O6.5V
P117	SK-66D100	05 27 45.59	-66 55 15.0	2000	13.26	O6II(f)
P117	HDE269582	05 27 52.75	-68 59 8.6	2000	11.88	WN10
P179	HD36705	05 28 44.50	-65 27 2.0	5030	6.83	K1III
P117	HD37026	05 30 12.22	-67 26 8.4	2000	14.30	WC4
P103	SK-71D45	05 31 18.00	-71 04 0.0	11600	11.47	O4If
P117	HDE269687	05 31 25.61	-69 05 38.4	2000	11.90	WN11
P103	SK-67D166	05 31 42.00	-67 38 6.0	12900	12.27	O4If+
P103	SK-67D169	05 31 48.00	-67 03 0.0	33900	12.18	B1Ia
P117	SK-67D167	05 31 51.98	-67 39 41.1	2000	12.54	O4Inf+
P119	HD36408	05 32 14.10	+17 03 30.0	2000	5.50	B7IIIe
P166	LMC-X-4	05 32 49.30	-66 22 14.0	10000	13.80	O7IV
P117	SK-67D191	05 33 34.12	-67 30 19.6	2000	13.46	O8V
P117	BI208	05 33 57.45	-67 24 20.0	4000	14.02	O7V
P117	HD37680	05 34 19.39	-69 45 10.0	2000	13.35	WC4
P101	HD36841	05 34 33.60	-00 23 12.0	5700	8.60	O8
P117	HD269810	05 35 13.92	-67 33 27.0	2000	12.26	O3III(f)
P116	HD37021	05 35 16.00	-05 23 4.0	2000	7.96	B0V
P113	SN1987A	05 35 28.13	-69 16 11.0	50000	19.60	SNR
P113	SN1987A-STAR3	05 35 28.40	-69 11 11.7	23000	15.80	B1V
P152	HD37062	05 35 31.00	-05 25 16.0	4000	8.20	B1Ve
P116	HD37061	05 35 31.30	-05 17 54.9	2000	6.82	B1V
P117	BI229	05 35 32.20	-66 02 37.6	2000	12.95	O7III
P117	SK-66D169	05 36 54.50	-66 38 25.0	2000	11.56	O9.7Ia+
P117	SK-66D172	05 37 5.56	-66 21 35.7	2000	13.13	O5V
P117	SK-68D135	05 37 48.60	-68 55 8.0	2000	11.36	ON9.7Ia+
P117	MK42	05 38 42.10	-69 05 54.7	2000	10.96	O3If/WN
P103	SK-69D243	05 38 42.80	-69 06 3.0	5800	9.50	O3+OB+WN5
P103	SK-69D246	05 38 54.00	-69 01 0.0	10400	11.13	WN7
P117	HDE269927	05 38 58.25	-69 29 19.1	2000	12.48	WN9
P117	SK-69D257	05 39 58.96	-69 44 4.3	4000	12.38	O9II
P116	HD37903	05 41 38.32	-02 15 32.6	2000	7.83	B1.5V
P116	HD38087	05 43 0.48	-02 18 45.4	2100	8.28	B5V
P117	BI272	05 44 23.18	-67 14 29.3	2000	13.20	O7II
Q119	HD39060	05 47 17.00	-51 04 3.0	20000	3.80	A5V
P117	SK-70D115	05 48 49.76	-70 03 57.5	2000	12.24	O6.5III

Prog ID	Target Name	RA (2000.0)	DEC (2000.0)	Exposure Time (s)	V	Object Type
P204	GD 71	05 52 27.4	+15 53 23	8000	13.0	DA
P102	HD39680	05 54 44.70	+13 51 17.0	1500	7.85	O6.5Vnepv
P118	HD39801	05 55 10.20	+07 24 25.2	10000	0.80	M2Ia
P104	HD39659	05 56 24.00	+46 06 17.0	5200	11.59	CSPN
P122	HD40005	05 56 50.60	+16 21 19.0	300	7.24	B3Vsb
P101	PKS0558-504	05 59 47.40	-50 26 52.0	54800	15.00	QSO
P116	WALKER67	06 04 37.20	-09 47 30.0	14100	10.79	B1.5V
P102	HD41161	06 05 52.50	+48 14 58.0	300	6.71	O8.5Vn
P102	HD42088	06 09 39.50	+20 29 16.0	1400	7.55	O6.5V
P102	HD42401	06 10 59.10	+11 59 41.0	780	7.35	B2V
Q201	HD44179	06 19 58.22	-10 38 14.7	20000	9.02	B8V
P104	WD0621-376	06 23 12.10	-37 41 29.0	8000	12.09	WD
P118	HD45348	06 23 57.00	-52 41 45.6	11720	-0.72	F0II
P102	HD45314	06 27 15.80	+14 53 22.0	1200	6.64	O9Vpe
P152	HD45677	06 28 17.00	-13 03 10.0	8000	7.60	B2IVe
P107	HS0624+6907	06 30 2.50	+69 05 4.0	2000	14.20	QSO
P116	HD46056	06 31 20.88	+04 50 4.0	2000	8.16	B1V
P102	HD46150	06 31 55.50	+04 56 35.0	1400	6.75	O5Vf
P116	HD46202	06 32 10.48	+04 58 0.1	2000	8.19	O9V
P151	HD47088	06 37 10.40	+06 03 33.2	2000	7.60	B1III
P151	HD47129	06 37 24.00	+06 08 7.1	1000	6.10	O8III
P151	HD47240	06 37 52.70	+04 57 25.1	2000	6.20	B1II
P102	HD47360	06 38 23.00	+04 37 27.0	8700	8.19	B0.5V
P151	HD47382	06 38 28.60	+04 36 26.1	5000	7.10	B0III
P102	HD47417	06 38 47.90	+06 54 7.0	1000	6.97	B0IV
P131	HD47732	06 40 28.60	+09 49 4.4	900	8.10	B3V
P131	HD47777	06 40 42.30	+09 39 21.4	975	7.90	B2V
P131	HDE261878	06 40 51.50	+09 51 49.8	2670	9.00	B3V
P131	HD47839	06 40 58.70	+09 53 44.5	300	4.70	O7V
P131	HD47961	06 41 27.40	+09 51 13.5	765	7.50	B3V
P102	HD48279	06 42 40.50	+01 42 58.0	4300	7.97	O8V
P104	HD48915	06 45 10.80	-16 41 58.0	20000	-1.46	A1V
P104	WD0642-166	06 45 11.00	-16 42 6.0	23000	8.30	WD
P119	HD50138	06 51 33.30	-06 58 0.0	8000	6.70	B6-B9e
P187	PSR0656+14	06 59 48.11	+14 14 21.5	12000	24.00	PSR
P102	HD52463	07 00 12.20	-27 47 60.0	460	8.30	B3V
P122	HD52266	07 00 21.10	-05 49 37.0	500	7.23	O9V
P116	HD53367	07 04 25.46	-10 27 16.7	22000	6.94	B0IVe
P101	VIIZW118	07 07 13.00	+64 35 59.0	61200	14.60	Syft1
P152	HD56014	07 14 15.00	-26 21 9.0	1000	4.70	B3IIIe
P204	WD0715-704	07 15 17.1	-70 25 08	8000	14.0	DA

Prog ID	Target Name	RA DEC (2000.0)		Exposure Time (s)	V	Object Type
P122	LS277	07 16 12.20	-08 31 14.0	13900	9.78	NA
P122	CD-20D2366	07 25 1.90	-21 09 33.0	4700	8.27	B0.5III
P102	HD58510	07 25 7.90	-21 10 27.0	1000	6.79	B1Ib-II
P133	NGC2371	07 25 35.30	+29 29 36.0	2000	14.80	WC8-OVI
P122	HD60196	07 32 11.90	-28 44 4.0	2900	9.01	B1III
P105	HD60369	07 33 1.80	-28 19 33.0	7300	8.15	O9IV
P107	MRK9	07 36 57.10	+58 46 14.0	2000	15.29	Syft1
P102	HD61347	07 38 16.10	-13 51 2.0	13000	8.43	O9Ib
P104	HD61421	07 39 20.40	+05 14 21.0	10000	0.38	F5IV-V
P101	MRK79	07 42 32.30	+49 48 41.0	89000	13.30	Syft1
P116	HD62542	07 42 37.12	-42 13 46.7	10000	8.03	B3V
P179	HD62044	07 43 18.70	+28 53 0.0	8550	4.28	K1III
P122	HD62866	07 45 12.90	-20 48 37.0	9400	9.01	B0.5IIIn
P118	HD62509	07 45 21.30	+28 01 36.6	20600	1.15	K0IIIp
P102	HD63005	07 45 49.00	-26 29 31.0	1900	9.13	O6Vf
P122	HD64568	07 53 38.20	-26 14 2.0	7500	9.38	O4Vf
P154	U-GEM	07 55 5.00	+22 00 5.0	12000	14.90	CV
P102	HD65079	07 57 3.90	+02 57 3.0	370	7.83	B2Vne
P207	RJ0757+5833	07 57 06.2	+58 32 59	10000	14.5	AGN
P107	IR07546+3928	07 58 0.00	+39 20 29.0	2000	14.36	Syft1
P122	HD66695	08 03 42.70	-27 02 47.0	6000	9.78	B0.5IV
P101	HD66788	08 04 8.20	-27 29 0.0	1600	9.45	O9V
P152	HD67888	08 08 38.00	-37 40 54.0	4000	6.40	B4Ve
P101	PG0804+761	08 10 58.50	+76 02 43.0	37600	15.20	QSO
P102	HD69106	08 14 3.80	-36 57 9.0	300	7.14	B0.5IVnn
Q112	IX-VEL	08 15 19.10	-49 13 21.0	6000	9.60	CV
P207	UGC4305	08 19 15.7	+70 42 52	20000	13.0	GAL
P116	HD73882	08 39 9.43	-40 25 9.7	10000	7.21	O9III
P102	HD74194	08 40 47.70	-45 03 31.0	9200	7.57	O8.5Ib
P114	VELA-XBRT	08 41 2.43	-44 44 1.8	10000	0.00	NEB
P204	WD0841+033	08 41 03.9	+03 21 17	8000	14.2	DA
P114	PG0839+399	08 43 12.70	+39 44 49.5	2000	14.60	sdOB
P102	HD74711	08 43 47.50	-46 47 56.0	1400	7.11	B1III
P102	HD74920	08 45 10.50	-46 02 19.0	800	7.53	O8V
P102	HD75309	08 47 27.90	-46 27 5.0	930	7.86	B1IIp
P101	TON951	08 47 42.40	+34 45 4.0	69500	14.00	Syft1
P122	HD77464	09 00 38.00	-51 33 20.0	300	6.70	B2.5V+B2.5V
P166	VELA-X-1	09 02 6.79	-40 33 17.4	10000	6.80	B0Ia
P107	IR09149-6206	09 14 59.10	-62 06 54.0	2000	13.55	Syft1
P101	HDE233622	09 21 33.50	+50 05 57.0	1900	9.97	B1.5
P107	MRK110	09 25 12.90	+52 17 10.0	2000	16.00	Syft1

Prog ID	Target Name	RA (2000.0)	DEC (2000.0)	Exposure Time (s)	V	Object Type
P198	IZW18	09 34 1.90	+55 14 26.1	18000	15.60	GAL
P104	WD0939+262	09 42 54.00	+26 00 0.0	37000	14.60	WD
P111	PG0946+301	09 49 40.99	+29 55 18.1	25000	16.20	QSO
P101	PG0953+414	09 56 52.40	+41 15 41.0	41600	15.00	QSO
P107	3C232	09 58 20.90	+32 24 2.0	2000	15.78	QSO
P133	NGC3132	10 07 1.80	-40 26 10.0	5200	0.00	AV+sdO
P101	HD88115	10 07 31.80	-62 39 12.0	1100	8.30	B1.5IIn
P107	TON1187	10 13 3.10	+35 51 22.0	2000	15.00	QSO
P102	HD89137	10 15 40.00	-51 15 25.0	640	7.98	ON9.7IIInp
P204	REJ1016-053	10 16 28.7	-05 20 34	8000	14.2	DAO+dMe
P204	WD1019-141	10 19 52.4	-14 07 35	15000	14.5	DA
P102	HD90087	10 22 20.80	-59 45 20.0	870	7.80	O9.5III
Q108	NGC3242	10 24 46.00	-18 38 38.9	1000	12.30	CSPN
Q114	HD90972	10 29 35.40	-30 36 25.0	3400	5.60	B9.5V
P101	HE1029-140	10 31 54.30	-14 16 51.0	27000	13.90	QSO
P102	HD91597	10 33 1.10	-60 50 41.0	10000	9.84	O9.5V
P102	HD91651	10 33 30.30	-60 07 35.0	2200	8.86	O9Vn
P104	WD1034+001	10 37 4.00	-00 08 20.0	6000	13.19	WD
P204	Feige 34	10 39 36.7	+43 06 10	4000	11.1	sdO
P102	HD92554	10 39 48.00	-60 55 0.0	12100	9.47	O9.5IIn
P101	HD92702	10 41 0.20	-57 36 3.0	5100	8.14	B1Iab
P117	HD92809	10 41 38.40	-58 46 19.0	2000	9.08	WC6
P117	HD93129A	10 43 57.40	-59 32 51.0	2000	8.84	O3If
P102	HD93146	10 43 59.90	-60 05 11.0	1600	8.45	O6.5Vf
P102	HD93206	10 44 23.00	-59 59 36.0	550	6.24	O9.7Ib
P102	HD93204	10 44 32.40	-59 44 30.0	3400	8.42	O5Vf
P102	HD93205	10 44 33.80	-59 44 15.0	1000	7.75	O3V
P102	HD93222	10 44 36.30	-60 05 28.0	1600	8.10	O7IIIf
P122	CPD-59D2600	10 44 41.50	-59 46 55.0	12400	8.61	O6V
P102	HD93250	10 44 45.10	-59 33 54.0	4200	7.38	O3Vf
P122	CPD-59D2603	10 44 48.00	-59 44 0.0	8600	8.77	O7V
P122	HDE303308	10 45 6.00	-59 40 5.0	7800	8.17	O3Vf
P101	HD93521	10 48 23.40	+37 34 13.0	300	7.06	O9Vp
P102	HD93827	10 48 31.40	-60 56 10.0	4500	9.31	B1Ibn
P102	HD93843	10 48 37.80	-60 13 25.0	440	7.34	O6IIIf
P101	HD93840	10 49 8.70	-46 46 42.0	700	7.77	B1Ib
P101	BD+38D2182	10 49 12.00	+37 59 0.0	4400	11.25	B3
Q101	HD94414	10 50 56.30	-77 07 27.0	48000	8.00	B2V
P102	HD94493	10 53 15.20	-60 48 53.0	450	7.23	B1Ib
P207	RJ1059+5628	10 58 37.7	+56 28 11	10000	14.1	BLLac
P186	TW-HYA	11 01 58.00	-34 43 36.0	3710	10.9	K7V

Prog ID	Target Name	RA (2000.0)	DEC	Exposure Time (s)	V	Object Type
P107	PG1100+772	11 04 13.90	+76 58 58.0	2000	15.72	QSO
P101	MRK421	11 04 27.30	+38 12 32.0	19000	12.24	Blazar
Q201	MRK36	11 04 58.5	+29 08 22	10000	15.5	GAL
Q101	HD96675	11 05 58.20	-76 07 49.0	10000	7.65	B7V
P110	HS1103+6416	11 06 10.85	+64 00 9.4	30000	15.80	QSO
P117	HD96548	11 06 17.20	-65 30 35.0	1000	7.70	WN8
P111	NGC3516	11 06 47.55	+72 34 6.9	14000	13.20	AGN
P102	HD96670	11 07 13.80	-59 52 23.0	7200	7.43	O8Ibf
P102	HD96715	11 07 32.90	-59 57 49.0	3500	8.26	O4Vf
P102	HD96917	11 08 42.40	-57 03 57.0	1500	7.08	O8.5Ibf
P122	HD97913	11 14 54.60	-59 10 29.0	3700	8.80	B0.5IVn
P101	HD97991	11 16 11.60	-03 28 20.0	300	7.41	B1V
P101	PG1116+215	11 19 8.70	+21 19 18.0	28600	14.80	QSO
P107	MRK734	11 21 47.10	+11 44 18.0	2000	15.07	Syft1
P110	HE1122-1649	11 24 42.82	-17 05 17.8	48000	16.50	QSO
P102	HD99857	11 28 27.00	-66 29 21.0	1600	7.45	B0.5Ib
P102	HD99890	11 29 5.80	-56 38 39.0	1100	8.28	B0III
P107	MRK1298	11 29 16.60	-04 24 8.0	2000	15.00	Syft1
P122	HD100199	11 31 6.90	-62 56 48.0	480	10.15	B0.5IIIne
P102	HD100213	11 31 10.60	-65 44 32.0	2000	8.22	O8.5Vn
P102	HD100276	11 31 48.10	-60 36 22.0	620	7.16	B0.5Ib
P192	PDS-55	11 31 55.00	-34 36 26.0	16000	11.60	dM2e
P101	HD100340	11 32 49.80	+05 16 36.0	700	10.12	B1V
P119	HD100546	11 33 25.60	-70 11 42.0	8000	6.80	B9Vne
P102	HD101131	11 37 48.40	-63 19 23.0	520	7.15	O6Vf
P122	HDE308813	11 37 58.50	-63 18 59.0	3300	9.28	B1III
P102	HD101190	11 38 10.00	-63 11 49.0	830	7.27	O6Vf
P102	HD101205	11 38 20.40	-63 22 22.0	440	6.42	O7IIInf
P207	RJ1139+5743	11 38 49.6	+57 42 44	10000	13.6	AGN
P101	NGC3783	11 39 2.00	-37 44 18.0	27600	12.24	Syft1
P102	HD101298	11 39 3.30	-63 25 46.0	2000	8.05	O6Vf

Prog ID	Target Name	RA DEC (2000.0)	Exposure Time (s)	V	Object Type
P102	HD101413	11 39 45.90 -63 28 39.0	2900	8.35	O8V
P102	HD101436	11 39 49.90 -63 28 43.0	1400	7.56	O6.5V
Q101	HD102065	11 43 37.80 -80 28 60.0	6000	6.57	B9IV
P107	1143-1810	11 45 40.50 -18 27 16.0	2000	14.58	Syft1
P132	PG1144+005	11 46 35.60 +00 12 29.8	4000	16.20	DOZ1
P102	HD102552	11 47 56.90 -60 33 54.0	3700	8.69	B1IIIn
P102	HD103779	11 56 57.60 -63 14 57.0	400	7.20	B0.5Iab
P101	CPD-72D1184	11 59 0.10 -73 25 46.0	4400	10.68	B0III
Q201	HD104174	11 59 37.57 -78 13 18.6	4000	4.90	B9Vn
P163	HD104237	12 00 5.10 -78 11 34.6	18000	7.00	TTAU
Q109	PG1159-035	12 01 46.00 -03 45 36.0	5000	14.90	PG1159
P102	HD104705	12 03 23.90 -62 41 45.0	720	7.76	B0Ib
P104	WD1202+608	12 04 37.00 +60 31 42.0	32000	13.57	WD(DAO+DA)
P107	PG1202+281	12 04 42.20 +27 54 11.0	2000	15.51	QSO
P117	HD104994	12 05 18.70 -62 03 8.0	2000	10.93	WN3pec
P111	NGC4151	12 10 32.51 +39 24 20.8	10000	12.50	AGN
P204	HZ 21	12 13 56.5 +32 56 37	12000	14.2	DO
P107	PG1211+143	12 14 17.60 +14 03 12.0	2000	14.63	Syft1
P107	PG1216+069	12 19 20.90 +06 38 38.0	2000	15.68	QSO
P108	MRK205	12 21 44.10 +75 18 38.0	200000	14.50	QSO
Q201	M100	12 22 54.9 +15 49 21	12000	9.79	GAL
P111	NGC4388	12 25 50.06 +12 39 23.7	10000	13.60	AGN
P107	MRK209	12 26 16.00 +48 29 37.0	2000	15.15	Gal
P101	3C273	12 29 6.70 +02 03 9.0	39000	12.86	QSO
P119	HD108767	12 29 52.50 -16 30 48.0	1000	3.00	B9.5V
P107	PG1229+204	12 32 3.60 +20 09 29.0	2000	15.26	Syft1
Q101	HD108927	12 32 20.00 -78 11 38.0	4000	7.73	B5V
P104	HD109540	12 33 6.70 +82 33 50.0	7000	13.45	CSPN
P207	RJ1233+0931	12 33 25.8 +09 31 23	10000	14.1	AGN
P101	HD109399	12 35 16.50 -72 42 59.0	900	7.61	B0.7II
P204	HS1234+481	12 36 45.3 +47 55 23	10000	14.4	DA
P207	RJ1237+4539	12 36 51.2 +45 39 04	10000	13.6	AGN
P134	NGC4631-A	12 42 8.80 +32 34 36.0	30000	0.00	GAL
P134	NGC4631-B	12 42 8.80 +32 33 36.0	20000	0.00	GAL
P134	NGC4631-C	12 42 8.80 +32 32 36.0	10000	0.00	GAL
P116	HD110432	12 42 50.32 -63 03 31.2	2000	5.24	B2Vpe
Q105	T1247-232	12 50 18.80 -23 33 57.0	22000	16.00	GAL
P118	HD111812	12 51 41.90 +27 32 26.9	3125	4.94	G0IIIp
P133	A35	12 53 41.40 -22 51 42.0	2000	0.00	G8IV+sdO
P204	GD 153	12 57 02.4 +22 01 56	8000	13.35	DA
P101	CPD-69D1743	13 00 33.70 -70 12 35.0	700	9.38	B0.5IIIn

Prog ID	Target Name	RA DEC (2000.0)	Exposure Time (s)	V	Object Type
P108	PG1259+593	13 01 12.90 +59 02 6.0	200000	15.60	QSO
P108	PKS1302-102	13 05 33.00 -10 33 19.0	200000	14.92	QSO
P107	PG1307+085	13 09 47.00 +08 19 49.0	2000	15.28	QSO
P110	HS1307+4617	13 10 11.69 +46 01 24.5	20000	16.80	QSO
P102	HD114441	13 11 29.50 -55 21 24.0	4300	8.02	B2IVpne
P102	HD115071	13 16 4.80 -62 35 1.0	10500	7.94	B0.5Vn
P104	HZ43	13 16 22.10 +29 05 56.0	21000	12.86	WD
P117	HD115473	13 18 27.70 -58 08 15.0	2000	9.98	WC5
Q201	NGC5102	13 21 56.70 -36 37 52.8	10000	9.65	GAL
P207	RJ1324+5739	13 24 00.8 +57 39 16	10000	13.9	AGN
P102	HD116538	13 25 11.90 -51 50 29.0	570	7.92	B2IVn
P102	HD116781	13 27 25.10 -62 38 56.0	2400	7.60	B0IIIne
P101	HD116852	13 30 23.20 -78 51 18.0	900	8.47	O9III
P101	HD118246	13 35 43.30 -06 09 22.0	500	8.07	B4V
P122	HD118571	13 39 15.70 -60 59 1.0	1700	8.76	B0.5IVn
P101	HD119069	13 41 55.70 -45 51 6.0	300	8.43	B1III
P101	VZ1128	13 42 16.8 +28 26 00.7	19400	14.9	PAGB
P122	HD118969	13 42 12.30 -63 42 50.0	7400	9.89	B1V
P101	HD119608	13 44 31.20 -17 56 13.0	700	7.51	B1Ib
P101	HD120086	13 47 19.10 -02 26 37.0	300	7.73	B2V
P112	ABELL1795	13 48 52.51 +26 35 35.1	40000	0.00	CLUS
P108	MRK279	13 53 3.40 +69 18 29.0	200000	14.57	Syft1
P107	PG1351+640	13 53 15.80 +63 45 45.0	2000	14.84	QSO
Q114	HD120991	13 53 56.80 -47 07 41.0	6600	6.10	B2IIIe
P101	HD121800	13 55 15.40 +66 07 0.0	1800	9.11	B1.5V
P111	MRK463	13 56 2.85 +18 22 18.9	10000	15.00	AGN
P101	HD121968	13 58 51.10 -02 54 53.0	1700	10.31	B1V
P107	PG1402+261	14 05 16.20 +25 55 34.0	2000	15.57	Syft1
P107	PG1411+442	14 13 48.40 +44 00 14.0	2000	14.99	Syft
Q110	HD125162	14 14 30.00 +46 20 0.0	7000	4.18	A0p
P102	HD124314	14 15 1.60 -61 42 24.0	2100	6.64	O6Vnf
P104	HD124897	14 15 43.50 +19 12 37.0	10000	-0.04	K1III
P101	NGC5548	14 17 59.50 +25 08 13.0	33600	13.10	Syft1
P102	HD124979	14 18 11.90 -51 30 13.0	3800	7.80	O8.5V
P101	HD125924	14 22 42.90 -08 14 53.0	1200	9.68	B2IV
P132	PG1424+535	14 25 55.50 +53 15 24.0	4000	16.20	DOZ1
P101	MRK1383	14 29 6.40 +01 17 6.0	26100	14.80	Syft1
P186	PROX-CEN	14 29 42.90 -62 40 47.0	2000	11.05	M5Ve
P108	MRK817	14 36 22.10 +58 47 39.0	200000	14.50	Syft1.5
P186	HD129333	14 39 1.10 +64 17 32.7	4650	7.54	G0V
P104	HD128621	14 40 0.70 -60 50 38.0	33000	1.33	K1V

Prog ID	Target Name	RA (2000.0)	DEC	Exposure Time (s)	V	Object Type
P104	HD128620	14 40 0.80	-60 50 42.0	22000	-0.01	G2V
P111	MRK477	14 40 38.06	+53 30 15.7	10000	15.90	AGN
P111	MRK478	14 42 7.46	+35 26 22.9	8000	14.60	AGN
P107	PG1444+407	14 46 45.90	+40 35 6.0	2000	15.95	QSO
P153	XI-BOOA	14 51 23.00	+19 06 7.0	8000	4.60	G8V
Q109	H1504+65	15 02 8.00	+66 12 26.0	11000	16.30	PG1159
P114	SMSTAR	15 02 53.10	-41 59 16.5	36000	16.70	sdOB
P102	HD132960	15 03 20.80	-41 16 17.0	300	7.39	B1IV
P107	MRK841	15 04 1.20	+10 26 16.0	2000	14.00	Syft1
P102	HD134411	15 11 8.80	-39 51 50.0	1100	9.56	B2V
P132	PG1520+525	15 21 46.90	+52 22 4.3	2000	15.52	DOZ1
P204	WD1529+486	15 29 43.5	+48 36 22	11000	14.7	DA
P107	MRK290	15 35 52.40	+57 54 9.0	2000	15.21	Syft1
P107	MRK487	15 37 4.20	+55 15 48.0	2000	15.45	Gal
P193	HD138403	15 37 11.60	-71 54 53.0	2000	10.47	CSPN
P104	HD140436	15 42 44.90	+26 17 42.0	2000	3.84	B9IV+A3V
P108	HS1543+5921	15 44 20.10	+59 12 26.0	200000	16.40	QSO
P207	RJ1556+1111	15 55 43.0	+11 11 24	10000	13.8	BLLac
P104	HE2-138	15 56 1.30	-66 09 7.0	5200	10.90	CSPN
P119	HD143939	16 04 44.40	-39 26 4.0	5000	7.10	B9p
P186	HD144668	16 08 34.20	-39 06 0.0	3825	7.05	A7IVe
P107	MRK876	16 13 57.20	+65 43 10.0	2000	15.23	Syft1
P101	HD146813	16 15 14.70	+55 47 58.0	1300	9.07	B1.5
P204	EG 118	16 17 55	-15 35 41	10000	13.4	DA
Q110	WD1620-391	16 20 12.00	-39 07 0.0	1000	11.00	WD
P116	HD147889	16 22 22.82	-24 21 7.2	12600	7.92	B2IV
P207	RXJ1625+7555	16 24 56.5	+75 54 56	10000	13.7	AGN
P107	PG1626+554	16 27 55.90	+55 22 31.0	2000	16.17	QSO
P112	ABELL2199	16 28 38.25	+39 33 4.3	40000	0.00	CLUS
P104	WD1631+781	16 29 11.10	+78 04 41.0	30000	13.28	WD
P101	HD148422	16 30 59.80	-56 29 42.0	6400	8.60	B1Ia
P116	HD147888	16 35 24.17	-23 27 36.3	6300	6.74	B3/B4V
P116	HD149404	16 36 22.44	-42 51 31.8	16600	5.47	O9I
Q103	EUVEJ1636-285	16 36 34.00	-28 32 0.0	4000	0.00	NoID
P101	HD149881	16 36 58.10	+14 28 31.0	300	7.03	B0.5III
P204	KUV16366+3506	16 38 26.4	+35 00 11	15000	14.7	DA
P104	HD149499B	16 38 30.00	-57 28 12.0	4000	11.70	WD
P101	BARNARD29	16 41 34.00	+36 26 6.0	7400	13.14	PAGB
P101	CPD-74D1569	16 50 50.00	-74 32 20.0	1700	10.15	O9.5V
P102	HD151805	16 51 35.60	-41 46 36.0	7200	8.91	B1IB
P117	HD151932	16 52 19.10	-41 51 16.0	600	6.49	WN7

Prog ID	Target Name	RA (2000.0)	DEC	Exposure Time (s)	V	Object Type
P107	MRK501	16 53 52.20	+39 45 37.0	2000	14.15	BLLac
P116	HD152236	16 53 59.61	-42 21 43.2	14100	4.73	B1Iape
P101	HD152218	16 53 59.90	-41 42 53.0	5900	7.61	O9.5IVn
P102	HD152233	16 54 3.30	-41 47 29.0	1400	6.56	O6IIIfp
P102	HD152248	16 54 9.80	-41 49 31.0	1400	6.10	O7Ibnfp
P102	HD152314	16 54 31.80	-41 48 19.0	4900	7.54	O9.5III-IV
P102	HD152623	16 56 14.90	-40 39 36.0	950	6.73	O7Vnf
P102	HD152723	16 56 54.50	-40 30 43.0	7100	7.10	O6.5IIIf
P166	HER-X-1	16 57 49.70	+35 20 33.0	10000	13.90	DA
P110	HS1700+6416	17 01 0.48	+64 12 8.9	500000	16.10	QSO
P102	HD153426	17 01 12.90	-38 12 13.0	4200	7.47	O9II-III
Q106	3C351	17 04 41.50	+60 44 28.0	18000	15.30	QSO
P116	HD154368	17 06 28.28	-35 27 4.0	2000	6.13	O9Ia
P132	PG1707+427	17 08 47.70	+42 40 59.6	13000	16.40	DOZ1
P102	HD155775	17 15 22.10	-38 12 46.0	430	6.67	B0.5III
P101	HD156359	17 16 36.60	-62 52 6.0	2100	9.68	O9.7Ib-II
P102	HD156292	17 18 45.60	-42 53 30.0	10000	7.49	O9.5III
P117	HD156385	17 19 29.80	-45 38 24.0	300	7.45	WC7
P107	MRK506	17 22 40.00	+30 52 53.0	2000	15.12	Syft1.5
P107	4C+34.47	17 23 20.80	+34 17 58.0	2000	16.50	QSO
P102	HD157857	17 26 17.30	-10 59 34.0	4100	7.78	O6.5IIIf
P118	HD159181	17 30 26.00	+52 18 10.3	2220	2.79	G2Iab
P101	HD158243	17 31 7.00	-53 28 43.0	2800	8.15	B1Iab
P122	HD158661	17 31 12.70	-17 08 32.0	12200	8.20	B0.5Ib
Q119	HD158643	17 31 24.80	-23 57 44.0	18000	4.80	A0V
P101	HD160993	17 45 17.60	-45 38 13.0	2000	7.73	B1Iab
P198	HEN2-274	17 45 35.30	-46 05 25.0	4000	11.40	CSPN
P205	BD+39D3226	17 46 31.9	+39 19 09	5000	10.2	Op
P122	HD161807	17 49 24.60	-38 59 0.0	300	6.99	B0IIIn
Q201	HD163296	17 56 21.29	-21 57 21.9	10000	6.87	A1V
Q108	NGC6543	17 58 33.30	+66 37 59.2	1000	11.10	CSPN
P101	HD163522	17 58 35.10	-42 29 10.0	2700	8.46	B1Ia
P102	HD163892	17 59 26.20	-22 28 1.0	1500	7.44	O9IVn
P101	HD163758	17 59 28.20	-36 01 16.0	2400	7.32	O6Ia
P204	KUV1800+685	18 00 09.5	+68 35 54	11000	14.7	DA
P117	HD164270	18 01 43.00	-32 42 54.0	2000	9.01	WC9
P107	KAZ102	18 03 28.80	+67 38 10.0	2000	15.78	Syft1
P116	HD164740	18 03 40.30	-24 22 44.0	3000	10.33	O7.5V
P101	HD164816	18 03 56.80	-24 18 45.0	600	7.08	O9.5III-IV
P102	HD164906	18 04 25.80	-24 23 10.0	1900	7.47	B1Ivpe

Prog ID	Target Name	RA DEC (2000.0)	Exposure Time (s)	V	Object Type
P122	HDE315021	18 04 35.80 -24 19 52.0	1900	8.57	B1V
P102	HD165052	18 05 10.50 -24 23 55.0	630	6.87	O6.5Vnf
P105	HD165246	18 06 4.60 -24 11 44.0	5000	7.71	O8Vn
P117	HD165763	18 08 28.30 -21 15 11.0	300	8.25	WC5
P102	HD165955	18 09 57.70 -34 52 7.0	2300	9.19	B3Vn
P122	HD166546	18 11 57.00 -20 25 25.0	570	7.24	O9.5III
P105	HD166716	18 12 28.40 -15 22 24.0	5400	8.00	B0II-II
P192	AS-292	18 14 10.00 -32 47 32.0	16000	9.70	K5
P122	HD167287	18 15 16.60 -18 59 33.0	510	7.09	B1Ib
P101	LS4825	18 16 0.40 -30 45 46.0	20000	11.99	B1Ib-II
P184	AM-HER	18 16 13.30 +49 52 4.0	2000	12.30	CV
P101	HD167402	18 16 18.50 -30 07 29.0	2300	8.95	B0Ib
P102	HD167659	18 16 58.50 -18 58 5.0	4200	7.39	O7IIf
P102	HD167771	18 17 28.40 -18 27 48.0	620	6.52	O7IIInf
P116	HD167971	18 18 5.76 +59 42 2.3	8300	7.31	B0V
P116	HD168076	18 18 36.33 -13 48 2.4	2000	8.21	O5f
P101	HD167756	18 18 39.90 -42 17 18.0	300	6.30	B0.5Ia
P122	HD168080	18 18 46.70 -18 10 20.0	2400	7.61	B0.5II
P101	H1821+643	18 21 57.00 +64 20 36.0	56800	14.20	QSO
P101	HD168941	18 23 25.50 -26 57 11.0	6400	9.34	O9.5II-III
P105	HD169673	18 26 23.60 -15 37 48.0	4800	7.34	B1II
P107	3C382	18 35 3.40 +32 41 47.0	2000	15.50	Syft1
Q108	IRAS18333-2357	18 36 23.30 -23 55 20.0	4000	14.30	CSPN
P104	HD172167	18 36 56.40 +38 46 47.0	20000	0.03	A0V
P101	HD172140	18 39 48.20 -29 20 21.0	3100	9.96	B0.5III
P133	IC4776	18 45 51.10 -33 20 40.0	5000	14.10	WC6
P101	HD173502	18 46 55.70 -29 57 35.0	2100	9.68	B0.5III
P204	Lanning 18	18 47 38.9 +01 57 37	8000	12.96	DA
Q113	V603-AQL	18 48 54.60 +00 35 2.9	6000	11.90	CV
P204	WD1847-223	18 47 56.5 -22 19 36	8000	13.9	DA
P101	HD175754	18 57 35.60 -19 09 11.0	300	7.01	O8IIf
P101	HD175876	18 58 10.70 -20 25 25.0	300	6.94	O6III
P119	HD176386	19 01 38.80 -36 53 26.0	14000	7.20	B9IV
P104	HD177756	19 06 14.90 -04 52 53.0	2000	3.44	B9Vn
P101	HD177566	19 07 7.60 -41 43 10.0	700	10.20	PAGB
P101	HD177989	19 07 36.50 -18 43 30.0	2100	9.33	B0III
P101	HD178487	19 09 14.70 -10 13 4.0	8800	8.66	B0Ib
P101	HD179407	19 12 52.90 -12 34 57.0	10800	9.41	B0.5Ib
P101	HD181653	19 16 24.16 +67 08 6.0	300	8.40	B1II-III
P101	E141-55	19 21 14.10 -58 40 13.0	100300	13.60	Syft1
P101	HD183899	19 32 45.10 -26 09 46.0	5700	9.80	B2III

Prog ID	Target Name	RA (2000.0)	DEC	Exposure Time (s)	V	Object Type
P116	HD185418	19 38 27.39	+17 15 26.3	2000	7.45	B0.5V
P122	HDE332407	19 41 19.80	+29 08 40.0	12600	8.50	B1Ib
P193	HD186924	19 44 48.14	+50 31 31.6	2000	10.50	CSPN
P101	HD225757	19 46 41.60	+34 39 14.0	7400	10.59	B1IIIn
P187	V3885-SGR	19 47 40.30	-42 00 28.0	12000	10.00	CV
P117	HD187282	19 48 32.20	+18 12 7.0	2000	10.56	WN4
P102	HD187459	19 48 50.50	+33 26 14.0	1600	6.48	B0.5Ib
P118	HD187642	19 50 45.10	+08 51 46.6	2000	0.77	A7V
P102	HD188001	19 52 21.70	+18 40 19.0	300	6.25	O7.5Iaf
P104	GCRV12336	19 59 36.10	+22 43 0.0	5200	13.94	CSPN
P102	HD190429	20 03 29.30	+36 01 30.0	2300	6.63	O4If
P102	HD190918	20 05 57.40	+35 47 18.0	1800	6.80	O9.5Iab/WN4
P122	HD191495	20 08 53.50	+35 30 46.0	5700	8.26	B0V
P204	REJ2009-602	20 09 05	-60 25 36	8000	13.6	DA
P107	PKS2005-489	20 09 25.40	-48 49 54.0	2000	15.30	BLLac
P117	HD191765	20 10 14.10	+36 10 36.0	1400	8.31	WN6
P102	HD192035	20 10 49.40	+47 48 48.0	6800	8.18	B0III-IV
P102	HD191877	20 11 21.00	+21 52 31.0	300	6.26	B1Ib
P117	HD192103	20 11 53.50	+36 11 51.0	1000	8.09	WC8
P204	WD2013+400	20 13 09.2	+40 02 24	8000	14.4	DA0+M3
P164	31CYG	20 13 37.90	+46 44 28.8	2000	3.79	ZAUR
P116	HD192639	20 14 30.32	+37 21 14.2	15000	7.11	O8e
P164	32CYG	20 15 28.30	+47 42 51.1	6000	3.98	ZAUR
P117	HD193077	20 17 0.10	+37 25 25.0	2000	7.97	WN5
P101	HD195455	20 32 14.60	-24 04 3.0	1000	9.20	B0.5III
P102	HD195965	20 32 25.50	+48 12 59.0	340	6.98	B0V
P104	HD196867	20 39 38.00	+15 54 43.0	2000	3.77	B9IV
P108	MRK509	20 44 9.80	-10 43 23.0	200000	13.00	Syft1
P118	HD197481	20 45 8.30	-31 20 9.2	15000	8.61	M0Ve
P114	CYGLP-W1	20 45 38.37	+31 06 32.6	8000	0.00	SNR
P114	CYGLP-W2	20 45 38.68	+31 06 32.6	8000	0.00	SNR
P101	BD+35D4258	20 46 12.50	+35 32 26.0	7400	9.35	B0.5Vn
P114	CYGLP-NE4	20 56 2.53	+31 56 36.5	8000	0.00	SNR
P114	CYGLP-NE3	20 56 2.60	+31 56 37.4	8000	0.00	SNR
P114	CYGLP-NE2	20 56 2.67	+31 56 38.3	8000	0.00	SNR
P114	CYGLP-NE1	20 56 2.74	+31 56 39.2	8000	0.00	SNR
P116	HD199579	20 56 34.67	+44 55 29.4	2000	6.01	O6Ve
P114	CYGLP-E1	20 57 21.34	+31 05 42.6	8000	0.00	SNR
P114	CYGLP-E2	20 57 22.85	+31 06 1.7	8000	0.00	SNR
P104	HD200516	21 04 10.80	-11 21 48.0	3500	12.78	CSPN

Prog ID	Target Name	RA (2000.0)	DEC	Exposure Time (s)	V	Object Type
P122	HD201345	21 07 55.30	+33 23 50.0	300	7.66	O9Vp
P101	HD201638	21 09 53.00	+35 29 31.0	1700	9.10	B0.5Ib
P104	WD2111+498	21 12 43.50	+50 06 17.0	38000	13.09	WD
P102	HD202347	21 13 41.80	+45 36 41.0	300	7.51	B1.5V
P132	WD2117+341	21 17 6.20	+34 12 15.4	8000	13.30	DOZ1
Q201	WD2117+539	21 18 56.00	+54 12 36.0	4000	12.36	DA
P101	HD203664	21 23 28.70	+09 55 55.0	400	8.59	B0.5V
P102	HD203699	21 23 35.20	+14 03 1.0	320	6.86	B2.5IVne
P116	HD203938	21 23 50.06	+47 09 52.6	7600	7.45	B0.5V
P101	HD204076	21 27 1.00	-31 56 21.0	1300	8.79	B1V
P204	WD2127-222	21 27 43.1	-22 11 48	12000	14.9	DA
P133	K648	21 29 59.40	+12 10 26.0	8200	15.00	sdO
P101	IIZW136	21 32 27.80	+10 08 17.0	53000	14.60	Syft1
P101	BD+48D3437	21 36 15.80	+49 20 57.0	9600	8.69	B1Iab
P104	NGC7094	21 36 53.00	+12 47 20.0	8700	13.68	CSPN
P116	HD206267	21 38 57.54	+57 29 20.8	2300	5.62	O6e
P116	HD207198	21 44 53.22	+62 27 38.3	12500	5.95	O9IIe
P116	HD207538	21 47 39.67	+59 42 2.3	10000	7.31	B0V
Q111	AG-PEG	21 51 2.00	+12 37 32.0	2000	9.40	SYMB
P205	BD+28D4211	21 51 11.0	+28 51 50	5000	10.5	sdOp
P207	FIRSTJ2155-0922	21 55 01.5	-09 22 25	20000	14.2	QSO
P204	WD2156-546	21 56 21.1	-54 38 23	15000	14.6	DA
P164	VV-CEP	21 56 39.10	+63 37 32.0	6000	4.91	VVCEP
P108	PKS2155-304	21 58 51.80	-30 13 30.0	200000	13.09	BLLac
P193	HD218066	22 04 2.11	+63 23 48.6	4000	7.62	B1V
P118	HD209750	22 05 46.90	-00 19 11.1	15625	2.90	G2Ib
P116	HD210121	22 08 11.76	-03 31 52.9	15000	7.67	B3V
P153	AR-LAC	22 08 41.00	+45 44 29.0	32000	6.10	K0IV
P116	HD210839	22 11 30.60	+59 24 52.7	4000	5.06	O6Iab
P122	HD210809	22 11 38.50	+52 25 48.0	1300	7.57	O9Iab
P122	BD+53D2820	22 13 49.50	+54 24 35.0	9000	9.95	B0IVn
P104	WD2211-491	22 14 12.30	-49 19 2.0	4000	11.71	WD
P122	HDE235783	22 17 6.90	+54 30 28.0	14100	8.68	B1Ib
P107	MRK304	22 17 12.20	+14 14 21.0	2000	15.08	Syft1
P122	HD212044	22 20 22.60	+51 51 40.0	550	6.98	B1V
P122	BD+52D3210	22 26 54.30	+53 38 42.0	6000	10.69	B1V
P122	BD+53D2885	22 27 7.30	+54 10 54.0	12000	10.46	B2III
P198	NGC7293	22 29 38.50	-20 50 18.0	2000	13.50	CSPN
P122	HDE235874	22 32 59.70	+51 12 56.0	4900	9.64	B3III
P101	HD214080	22 36 6.31	-16 23 16.0	300	6.80	B1Ib
P104	HD214923	22 41 27.40	+10 49 53.0	2000	3.40	B8V

Prog ID	Target Name	RA DEC (2000.0)	Exposure Time (s)	V	Object Type
P101	HD215733	22 47 2.40 +17 14 0.0	300	7.34	B1II
P122	HD216044	22 48 43.20 +55 07 34.0	5800	8.51	B0II
P122	HD216438	22 51 58.20 +53 42 35.0	4700	8.46	B1II
P111	MR2251-178	22 54 5.80 -17 34 55.0	9000	14.40	QSO
P193	HD217312	22 58 39.67 +63 04 37.8	4000	7.41	B0IV
P101	NGC7469	23 03 15.60 +08 52 26.0	33600	13.00	Syft1
P111	NGC7469	23 03 15.60 +08 52 26.0	16000	13.00	AGN
P107	MRK926	23 04 43.40 -08 41 8.0	2000	14.50	Syft1.5
P104	HD218045	23 04 45.40 +15 12 21.0	2000	2.45	B9V
P107	NGC7496	23 09 47.30 -43 25 40.0	2000	11.91	Syft2
P101	HD218915	23 11 6.90 +53 03 30.0	1000	7.20	O9.5Iab
P104	GD246	23 12 21.00 +10 47 0.0	19000	13.10	WD
P101	HD219188	23 14 0.50 +04 59 50.0	300	6.93	B0.5II-III
P122	HD220057	23 20 0.60 +61 09 0.0	920	6.93	B3IVsb
P112	ABELL2597	23 25 19.72 -12 07 27.0	40000	0.00	CLUS
P132	HS2324+3944	23 27 15.70 +40 01 22.0	2000	14.80	DOZ1
P104	WD2331-475	23 34 1.20 -47 13 55.0	19000	13.44	WD
P179	HD222107	23 37 33.90 +46 27 29.0	8550	3.70	G8IV
P110	HE2347-4342	23 50 34.24 -43 26 0.0	500000	16.00	QSO
P107	PG2349-014	23 51 56.10 -01 09 13.0	2000	15.33	Syft1
P179	HD224085	23 55 1.80 +28 37 59.0	3600	7.20	K2IV
P122	HD224151	23 55 33.70 +57 24 44.0	1600	6.01	B0.5II-III
P105	HD224257	23 56 24.90 +55 59 26.0	1100	8.00	B0.2IV
P105	OVIFOLLOWUP	99 99 99.90 -99 99 99.0	300000	9.99	Many*s
P106	OVIFOLLOWUP	99 99 99.90 -99 99 99.0	300000	9.99	Many*s
P109	JUPITER	99 99 99.90 -99 99 99.0	72000	9.99	SOL
P180	COMET-TOO	99 99 99.90 -99 99 99.0	25000	9.99	SOL
P120	IO-TORUS-MDRS	99 99 99.99 -99 99 99.9	20000	9.99	SOL
P120	IO-TORUS-LWRS	99 99 99.99 -99 99 99.9	20000	9.99	SOL
P120	JUPITER-AURORA	99 99 99.99 -99 99 99.9	12000	9.99	SOL
P120	JUPITER-CENTER	99 99 99.99 -99 99 99.9	20000	9.99	SOL
P120	SATURN	99 99 99.99 -99 99 99.9	12000	9.99	SOL
P120	VENUS	99 99 99.99 -99 99 99.9	10000	9.99	SOL
P123	SN2001ZZ-TOO	99 99 99.99 –99 99 99.9	30000	12.0	SN

FUSE Cycle 1 GI Target List

This Appendix contains targets planned for observation for Cycle 1 GI programs. The listing is sorted in order of increasing Right Ascension (J2000.0). The listing is based on Phase 2 proposals submitted to the FUSE Science Center at JHU.

The information listed below includes the Program Identification, target name, J2000 coordinates, total planned exposure time, V magnitude (when appropriate), and an indicator of the spectral type or general object type.

PgmID	Target Name	RA (J2000)	DEC	V	Object Type	Exposure (sec)
A085	NGC40	00:13:01.10	+72:31:19.13	12.20	WC8	40000
A003	RXJ0019+22	00:19:50.0	+21:56:54	12.40	CV	40000
A083	HD2151	00:25:45.07	-77:15:15.3	2.82	G2IV	17000
A053	HS-0035+4405	00:37:52.30	+44:21:32.4	16.70	QSO	4000
A061	M31-OB78-159	00:40:28.4	+40:43:14	18.00	B0	5500
A061	M31-NGC206-231	00:40:29.8	+40:44:30	18.30	O8	10000
A061	M31-OB78-277	00:40:30.3	+40:42:33	18.00	B1	10000
A061	M31-OB78-292	00:40:30.6	+40:45:28	18.00	O	7000
A088	NGC221	00:42:41.8	+40:41:52	8.82	GAL	50000
A134	EG-AND	00:44:37.18	+40:40:45.6	7.50	WD+M2III	30000
A118	AZV18	00:47:13.10	-73:06:24.8	12.48	B3Ia	9110
A118	AZV70	00:50:18.14	-72:38:09.8	12.39	O9Ia	4000
A075	E0102-P1	01:04:01.07	-72:02:03.5		SNR	10000
A034	EGB1	01:07:17.6	+73:33:46	16.55	WD	7520
A118	AZV462	01:11:25.88	-72:31:21.0	12.54	B2Ia	4000
A013	WD0109+111	01:12:22.74	+11:23:36.23	15.40	DO	4000
A013	WD0111+002	01:13:46.61	+00:28:28.30	14.80	DO	4000
A053	HS-0119+1432	01:21:56.05	+14:48:23.7	16.10	QSO	4000
A061	M33-FUV016	01:32:37.7	+30:40:06	17.00	O	4000
A086	NGC588	01:32:45.5	+30:38:55	13.00	GAL	4000
A061	M33-OB21-108	01:33:00.8	+30:35:05	17.00	GAL	4500
A086	NGC592	01:33:12.3	+30:38:49	14.00	GAL	4000
A086	NGC595	01:33:33.6	+30:41:32	14.00	O	4500
A061	M33-FUV297	01:33:50.6	+30:39:48	19.10	O	10000

PgmID	Target Name	RA (J2000)	DEC	V	Object Type	Exposure (sec)
A061	M33-FUV425	01:33:52.3	+30:39:21	17.00	O	5500
A061	M33-FUV420	01:33:52.5	+30:39:40	18.80	O	10000
A061	M33-FUV350	01:33:56.0	+30:45:31	18.00	O	5500
A061	M33-OB2-4	01:33:58.7	+30:35:26	17.00	O	4500
A061	M33-FUV444	01:34:09.9	+30:39:11	17.70	O	6000
A086	NGC604	01:34:32.5	+30:47:04	13.00	GAL	4000
A063	BD+32D270	01:34:52	+32:55:54	10.29	B2V	4000
A041	HD11636	01:54:38.40	+20:48:28.8	2.64	A5V	10000
A118	BD+56D524	02:19:06.42	+57:07:33.5	9.75	B1V	11000
A118	HD14250	02:20:15.71	+57:05:54.9	8.96	B1IV	7480
A054	HD15638	02:28:19.0	-61:18:19.4	14.80	WD	4300
A121	Mrk595	02:41:34.91	+07:11:13.96	14.69	AGN	4000
A139	NGC1068-POS-1	02:42:40.74	-00:00:47.97		AGN	6000
A139	NGC1068-POS-2	02:42:40.76	-00:00:47.48		AGN	6000
A139	NGC1068-POS-3	02:42:40.78	-00:00:46.98		AGN	14000
A139	NGC1068-POS-4	02:42:40.81	-00:00:46.48		AGN	20000
A139	NGC1068-POS-5	02:42:40.85	-00:00:45.57		AGN	21000
A139	NGC1068-POS-6	02:42:40.90	-00:00:44.32		AGN	16000
A139	NGC1068-POS-7	02:42:40.98	-00:00:42.67		AGN	30000
A002	4U0241+61	02:44:57.70	+62:28:06.5	14.00	QSO	10000
A023	NGC1140	02:54:33.58	-10:01:39.9	12.50	GAL	4000
A054	HD18131	02:54:38.8	-05:19:50.8	14.10	WD	4000
A041	HD18978	03:02:23.51	-23:37:28.0	4.09	A4IV	12000
A010	EUVE-J0317-85.5	03:17:17.74	-85:32:26	14.80	DAp	10000
A083	HD20630	03:19:21.70	+03:22:12.7	4.84	G5V	11000
A036	SBS0335-052	03:37:43.99	-05:02:39.0	16.65	GAL	25000
A088	NGC1399	03:38:29.3	-25:27:01	9.63	GAL	15000
A068	NGC1404	03:38:52.01	-35:35:34.0	9.89	GAL	5000
A120	HD23060	03:43:23.96	+34:06:58.6	7.50	B2Vp	4000
A120	HD23478	03:46:40.84	+32:17:24.2	6.60	B3IV	882
A120	HD23625	03:47:52.61	+33:36:00.0	6.50	B1.5V	4000
A120	HD24190	03:52:18.94	+34:13:19.9	7.40	B2V	4000
A106	HD24357	03:53:10.04	+17:19:37.5	5.97	F4V	4000
A106	HD25102	03:59:40.49	+10:19:49.5	6.37	F3V	4000
A106	HD26462	04:11:20.17	+05:31:24.0	5.72	F4V	4000
A106	HD26737	04:14:30.42	+22:27:06.7	7.06	F5V	4000
A054	HD27483	04:20:52.6	+13:51:52.1	14.50	WD	4000
A106	HD27534	04:21:32.26	+18:25:03.3	6.80	F6V	4000
A106	HD27731	04:23:30.39	+24:24:19.1	7.19	F5V	4000
A106	HD27808	04:24:14.57	+21:44:10.2	7.14	F7V	4000
A106	HD27848	04:24:22.27	+17:04:44.0	6.97	F6V	4000

PgmID	Target Name	RA (J2000)	DEC	V	Object Type	Exposure (sec)
A106	HD27901	04:24:57.12	+19:02:31.2	5.97	F4V	4000
A106	HD27991	04:25:37.34	+15:56:28.1	6.50	F7V	6000
A106	HD28033	04:26:18.49	+21:28:13.6	7.38	F8V	4000
A109	DF-TAU	04:27:02.79	+25:42:22.6	11.50	M0Ve	25000
A106	HD28205	04:27:35.89	+15:35:20.9	7.42	F8V	4000
A106	HD28237	04:27:46.07	+11:44:11.1	7.51	F8V	4000
A106	HD28406	04:29:30.27	+17:51:47.4	6.92	F6V	4000
A106	HD28483	04:30:17.96	+19:50:22.8	7.10	F5V	4000
A106	HD28568	04:30:46.73	+16:08:55.1	6.51	F2V	4000
A106	HD28608	04:30:57.12	+10:45:06.4	7.05	F7V	4000
A106	HD28677	04:31:51.72	+15:51:05.6	6.02	F4V	6000
A106	HD28911	04:33:46.59	+13:15:07.1	6.62	F5V	4000
A106	HD29225	04:36:40.72	+15:52:09.3	6.65	F5V	4000
A052	Tol0440-381	04:42:07.8	-38:01:03	16.00	GAL	28000
A151	IPM-Downwind	04:47:24	+17:10:00		IPM	5000
A106	HD30738	04:50:48.54	+16:12:37.4	7.30	F5V	4000
A106	HD30869	04:51:49.93	+13:39:18.2	6.27	F6V	4000
A049	Sk-68.03	04:52:15.56	-68:24:26.9	13.13	O9I	4000
A049	Sk-65.01	04:54:06.62	-65:35:22.5	12.50	B0-1	6000
A046	NGC1705	04:54:13.48	-53:21:39.4	12.40	GAL	18000
A049	Sk-66.18	04:55:59.88	-65:58:30.0	13.50	O6V((f))	4000
A049	Sk-67.28	04:58:39.29	-67:11:18.9	12.28	B0.7Ia	6000
A106	HD31845	04:59:44.28	+15:55:00.2	6.75	F5V	4000
A054	HD32008	04:59:50.4	-10:15:46.8	12.90	WD	4000

PgmID	Target Name	RA (J2000)	DEC	V	Object Type	Exposure (sec)
A001	HE0504-2408	05:06:18.16	-24:04:01.9	15.20	DO	4000
A049	Sk-67.46	05:07:01.62	-67:37:29.6	12.34	B1	4000
A049	Sk-71.08	05:07:23.41	-71:11:54.5	13.25	O9II	3600
A003	RXJ0513-69	05:13:50.8	-69:51:47	16.70	CV	12000
A054	HD33959C	05:15:23.6	+32:41:05.1	13.90	WD	4000
A024	V1309-Ori	05:15:41.42	+01:04:40.4	15.50	CV	12000
A070	HD34078	05:16:18.15	+34:18:44.3	5.99	O9.5V	16980
A049	Sk-70.85	05:17:05.75	-70:19:23.1	12.30	B0	6000
A049	Sk-65.41	05:19:05.45	-65:40:03.5	12.82	B1	4000
A123	Br22	05:19:16.5	-69:39:20.9	12.30	WC4+O5V	64000
A049	Sk-68.75	05:23:28.52	-68:12:22.8	12.03	B0.5	4000
A075	N132D-P1	05:25:00.81	-69:38:34.1	99.00	SNR	15000
A111	Sk-67.106	05:26:15.20	-67:29:58.3	11.78		9000
A111	Sk-67.107	05:26:20.67	-67:29:55.4	12.50	B0I	9000
A049	Sk-65.63	05:28:39.50	-65:39:01.1	12.56	O9.7I	6000
A133	SK-67.166	05:31:42.42	-67:38:08.9	12.27	O4If+	120000
A044	4U0532-664	05:32:49.58	-66:22:13.5	14.00	O8IV	40000
A048	HH1F	05:36:20.23	-06:45:07.3			14000
A063	HD37525	05:39:01.40	-02:38:56.4	8.08	B5V	4000
A049	Sk-71.50	05:40:43.32	-71:28:59.3	13.44	O6.5III	6000
A063	NGC2023-POS1	05:41:39.50	-02:15:14.9		REF	1525
A063	NGC2023-POS2	05:41:44.05	-02:15:07.6		REF	7057
A065	HH2	05:42:25.49	-06:47:40.3		OTR	40000
A049	Sk-66.185	05:42:30.55	-66:18:10.7	13.11	B0Iab	6000
A024	BY-Cam	05:42:49.00	+60:51:30.9	15.50	CV	24000
A063	IC435-POS1	05:43:01.58	-02:18:28.5		REF	4468
A063	IC435-POS2	05:43:02.52	-02:18:14.4		REF	14302
A003	CAL83	05:43:33.5	-69:22:23	16.80	CV	20000
A049	Sk-68.171	05:50:22.79	-68:11:26.4	12.02	B1Ia	4000
A049	Sk-70.120	05:51:20.85	-70:17:08.7	11.59	B1Ia	4000
A049	Sk-69.305	05:54:12.75	-69:29:55.6	13.05	OB	6000
A034	RE-J0558-376	05:58:14.45	-37:34:24.8	14.37	WD	2000
A013	WD0640+015	06:43:14.43	+01:30:03.63	15.40	DO	6000
A063	HD51013	06:54:41.14	-24:15:20.4	8.81	B3V	4000
A001	HS0713+3958	07:17:02.67	+39:53:23.6	16.20	DO	8000
A002	B0736+017	07:39:18.03	+01:37:04.6	16.40	QSO	14000
A126	U-Gem	07:55:05.29	+22:00:05.7	9.10	CV	44000
A129	HD71019	08:23:25.2	-42:48:24.8	8.30	B3II-III	4000
A129	HD71336	08:25:07.0	-43:21:53.7	7.97	B3III-IV	720
A048	HH47A	08:25:50.41	-50:59:50.3		OTR	7000
A129	HD72089	08:29:06.9	-45:33:26.9	7.60	B5II-III	735

PgmID	Target Name	RA (J2000)	DEC	V	Object Type	Exposure (sec)
A129	HD72088	08:29:12.6	-44:53:05.8	9.07	B3III-IV	4000
A129	HD72179	08:29:37.8	-44:05:57.4	8.14	B4II-III	807
A129	HD72350	08:30:39.2	-44:44:14.0	6.30	B4IV	4000
A129	HD72537	08:31:36.6	-45:47:05.4	7.00	B3V	480
A129	HD72648	08:32:18.9	-43:55:53.0	7.61	B2Ib	4000
A053	HS-0834+1509	08:37:12.88	+14:59:17.8	16.80	QSO	4000
A129	HD74662	08:43:18.7	-48:20:43.0	8.82	B3V	4000
A041	HD76644	08:59:12.44	+48:02:30.1	3.14	A7IV	6000
A054	HD78791	09:05:08.8	-72:36:09.7	14.50	WD	4000
A002	IRAS09149-62	09:16:09.41	-62:19:29.5	13.50	QSO	10000
A121	Mrk106	09:19:55.25	+55:21:36.6	16.15	AGN	2000
A060	PG0947+396	09:50:48.37	+39:26:51.1	16.40	WD	9000
A034	PG0948+534	09:51:25.86	+53:09:30.66	15.27	QSO	4000
A034	EGB6	09:52:58.98	+13:44:33.65	16.00	WD	7800
A060	PG1001+054	10:04:20.13	+05:13:00.3	16.10	QSO	16000
A035	PG-1004+130	10:07:26.10	+12:48:55.9	15.20	QSO	87000
A022	BD+20D2465	10:19:36.4	+19:52:11	9.43	M3Ve	100000
A121	HARO2	10:32:31.83	+54:24:03.41	13.20	AGN	42000
A099	KUV-1031+398	10:34:38.61	+39:38:28.4	15.60	AGN	50000
A118	HD91824	10:34:46.59	-58:09:22.9	8.16	O6	4000
A046	NGC3310	10:38:45.69	+53:30:06.0	10.80	GAL	26000
A120	HD93237	10:41:51.54	-79:46:59.3	5.90	B4IVe	2000
A118	HD93028	10:43:15.40	-60:12:04.5	8.39	O8	4000
A093	NovaVel1999	10:44:49.5	-52:25:35	9.80	Nova	30000
A068	NGC3379	10:47:49.5	+12:34:56.9	9.24		5000
A094	Mrk153	10:49:05.15	+52:20:05.11	15.05	GAL	65000
A120	HD94454	10:51:30.35	-75:52:57.4	6.60	B8III	5645
A060	PG1048+342	10:51:43.86	+33:59:26.6	15.80	QSO	10000
A151	IPM-Crossflow_	1 10:59:30	+00:20:00	IPM		5000
A023	NGC3504	11:03:11.21	+27:58:21.0	10.90	GAL	10865
A053	HS-1104+4259	11:07:04.75	+42:43:40.0	16.80	QSO	4000
A053	HS-1104+0452	11:07:08.43	+04:36:17.6	16.60	QSO	4000
A054	HD97277	11:11:39.5	-22:49:32.2	13.90	WD	4000
A118	HD97471	11:12:07.05	-58:48:14.3	9.30	B0V	4000
A053	HS-1110+1537	11:12:52.51	+15:21:24.0	16.80	QSO	4000
A155	HD97528(3)	11:13:12.48	-26:27:54.9	7.30	B9.5Ve	18000
A041	HD97603	11:14:06.50	+20:31:25.3	2.56	A4IV	10000
A060	PG1114+445	11:17:06.42	+44:13:34.13	16.00	QSO	13000

PgmID	Target Name	RA (J2000)	DEC	V	Object Type	Exposure (sec)
A060	PG1115+407	11:18:30.34	+40:25:54.8	16.00	QSO	9000
A121	ESO265-G23	11:20:47.89	-43:15:50.55	15.00	AGN	2000
A120	HD99872	11:28:18.34	-72:28:27.3	6.00	B3V	4000
A004	SY-MUS	11:32:10.11	-65:25:11.1	11.00	OTR	4000
A036	MKN1450	11:38:35.69	+57:52:26.6	15.00	-	9700
A053	HS-1140+2711	11:42:54.30	+26:54:58.3	16.70	QSO	4000
A041	HD102647	11:49:03.58	+14:34:19.4	2.14	A3V	6000
A023	NGC3991	11:57:30.8	+32:20:12.1	13.10	GAL	4000
A060	PG1202+281	12:04:42.20	+27:54:12.0	15.00	QSO	16000
A058	TON1480	12:15:09.21	+33:09:55.25	16.50	QSO	24000
A046	NGC4214	12:15:39.41	+36:19:35.1	9.80	GAL	22000
A120	HD106943	12:18:06.81	-61:28:11.7	7.50	B7IV	4000
A120	HD108002	12:24:55.98	-65:12:40.0	6.90	B2Ia	4000
A068	NGC4374	12:25:03.75	+12:53:14.2	9.11	GAL	5000
A046	NGC4449-HII	12:28:09.37	+44:05:15.8	9.60	GAL	21000
A046	NGC4449-NUC	12:28:10.81	+44:05:42.9	9.60	GAL	22000
A130	HD108662	12:28:54.72	+25:54:46.4	5.29	A0p	20000
A120	HD108610	12:28:54.80	-61:52:15.9	6.90	B3IV	4000
A120	HD108639	12:29:09.53	-60:48:17.3	7.80	B1III	4000
A068	NGC4472	12:29:46.79	+08:00:02	8.41	GAL	5000
A117	VirgoI	12:30:49.10	+12:23:31.0		CLU	1800
A117	VirgoII	12:31:07.30	+12:23:46.0		CLU	2300
A117	VirgoIII	12:31:13.40	+12:22:10.0		CLU	8000
A120	HD110020	12:39:55.84	-66:30:40.2	6.30	B8V	4000
A120	HD110434	12:42:49.49	-66:27:28.2	7.50		4000
A068	NGC4636	12:42:49.7	+02:41:18	9.49	GAL	5000
A088	NGC4649	12:43:39.6	+11:33:10	9.83	GAL	15000
A084	EX-HYA	12:52:24.47	-29:14:57.5	13.00	CV	20000
A052	Mrk54	12:56:55.9	+32:26:52	15.50	GAL	23000
A036	MKN59	12:59:00.33	+34:50:44.1	14.00	GAL	5800
A117	ComaI	12:59:49.00	+27:57:46.0		CLU	27000
A120	HD112999	13:01:34.91	-60:40:17.8	7.38		6590
A083	HD114710	13:11:52.39	+27:52:41.5	4.23	G0V	25000
A060	PG1309+355	13:12:17.74	+35:15:20.6	15.50	QSO	10000
A053	HS-1310+4308	13:12:48.75	+42:52:36.6	16.50	QSO	4000
A118	HD114444	13:13:04.43	-75:18:49.3	10.32	B2III	4000
A120	HD114886	13:14:44.50	-63:34:51.3	7.00		4000
A120	HD115455	13:18:35.47	-62:29:27.4	7.97	O8	4772
A041	HD115892	13:20:35.82	-36:42:44.3	2.75	A2V	12000
A060	PG1322+659	13:23:49.49	+65:41:48.3	15.90	QSO	6000
A108	NGC5139-ROA5342	13:25:45.4	-47:24:02	15.89	sdO	6000

PgmID	Target Name	RA (J2000)	DEC	V	Object Type	Exposure (sec)
A149	NGC5189-STAR	13:33:32.9	-65:58:26.6	13.80	DO	7100
A046	M83	13:37:00.51	-29:52:00.5	7.50	GAL	25000
A046	NGC5253	13:39:55.97	-31:38:27	10.40	GAL	26000
A053	HE-1338-0724	13:41:03.48	-07:39:48.7	15.70	QSO	4000
A034	PG1342+444	13:44:27.3	+44:08:33	16.60	WD	8180
A053	HS-1345+2855	13:48:04.32	+28:40:25.3	17.20	QSO	4000
A053	HE-1347-2457	13:50:38.88	-25:12:17.0	16.50	QSO	4000
A149	NGC5315-STAR	13:53:57.09	-66:30:50.3	14.50	DO	20000
A060	PG1352+183	13:54:35.66	+18:05:17.5	15.80	QSO	11000
A086	NGC5461	14:03:41.3	+54:19:05	14.00	GAL	4500
A060	PG1411+442	14:13:48.32	+44:00:13.14	15.00	QSO	6000
A060	PG1415+451	14:17:00.84	+44:56:06.0	15.70	QSO	11000
A036	SBS1415+437	14:17:01.40	+43:30:04.7	15.50		28500
A060	PG1425+267	14:27:35.62	+26:32:15.27	15.70	QSO	13000
A060	PG1427+480	14:29:43.12	+47:47:26.2	16.30	QSO	6000
A060	PG1512+370	15:14:43.10	+36:50:50.3	16.00	QSO	6000
A108	NGC5904-ZNG1	15:18:34.07	+02:04:59.4	14.20	sdO	4000
A120	HD137595	15:28:02.32	-33:32:42.3	7.50	B3Vn	4000
A120	HD140037	15:42:40.10	-32:11:09.2	7.50	B5III	4000
A060	PG1543+489	15:45:30.33	+48:46:09.51	16.10	QSO	8000
A053	HS-1549+1919	15:51:52.44	+19:11:03.5	15.60	QSO	4000
A109	RU-LUPI	15:56:42.32	-37:49:15.3	10.50	G5Ve	25000
A120	HD144965	16:10:10.57	-40:07:44.5	7.00	B3Vne	7870
A120	HD147683	16:24:43.72	-34:53:37.5	6.90	B4V	5268
A085	NGC6210	16:44:29.5	+23:48:01	12.20	O6	6000
A004	KX-TRA	16:44:35.51	-62:37:13.4	12.10	OTR	4000
A100	ALPHA-TRA	16:48:39.89	-69:01:39.8	1.92	K3II	50000
A151	IPM-Upwind	16:50:50	-15:26:00		IPM	5000
A004	AS210	16:51:20.38	-26:00:26.5	12.50	OTR	4000
A004	HEN3-1341	17:08:36.61	-17:26:30.0	12.90	OTR	4000
A034	RE-J1738+665	17:38:02.47	+66:53:47.8	14.65	WD	4000
A026	NGC6397-ROB162	17:40:38.35	-53:38:31.6	13.20	SDO	17000
A118	HD161056	17:43:47.02	-07:04:46.1	6.30	B1.5V	4000
A155	HD173787	18:47:52.26	-20:16:27.9	6.80	B2V	14000
A108	NGC6723-III60	18:59:29.0	-36:40:49.0	15.61	sdO	4000
A134	BF-CYG	19:23:53.55	+29:40:38.91	12.00	WD+M5III	4700
A054	RE-J1925-56	19:25:58.5	-56:33:35.3	14.40	WD	4000
A023	IRAS19245-4140	19:27:58.02	-41:34:27.7	13.00	GAL	4851
A085	BD+30D3639	19:34:45.2	+30:30:59	10.20	WC9	24000
A134	V1016-CYG	19:57:04.99	+39:49:36.5	11.00	WD+M4III	12000
A149	NGC6905-STAR	20:22:22.98	+20:06:16.5	14.20	DO	8900

PgmID	Target Name	RA (J2000)	DEC	V	Object Type	Exposure (sec)
A118	HD197770	20:43:13.61	+57:06:50.1	6.31	B2III	4000
A004	V1329CYG	20:51:01.27	+35:34:53.3	12.90	OTR	4000
A066	CYGLP-N4	20:54:36.39	+32:17:39.0		SNR	16000
A066	CYGLP-N3	20:54:36.67	+32:17:42.6		SNR	16000
A066	CYGLP-N2	20:54:36.95	+32:17:46.1		SNR	16000
A066	CYGLP-N1	20:54:37.45	+32:17:49.6		SNR	16000
A004	CD-42D14304	21:00:06.34	-42:38:44.6	11.50	OTR	4000
A051	HD200775	21:01:36.76	+68:09:48.1	7.42	B2Ve	19000
A121	1H2107-097	21:09:09.96	-09:40:15	14.39	AGN	4000
A041	HD203280	21:18:34.77	+62:35:08.1	2.44	A7V	50000
A054	HD204188	21:26:26.6	+19:22:32.2	14.40	WD	4000
A118	HD239683	21:29:53.41	+57:48:57.2	9.32	B3IV	8200
A118	HD239729	21:39:27.36	+57:29:01.5	8.35	B0V	8200
A126	SS-Cyg	21:42:42.66	+43:35:09.5	8.20	CV	30000
A002	B2145+067	21:48:05.46	+06:57:38.6	16.40	QSO	16000
A053	HE-2156-4020	21:59:54.72	-40:05:50.2	16.10	QSO	4000
A002	B2200+420	22:02:43.29	+42:16:40.0	14.50	QSO	10000
A034	WD2218+706	22:19:33.79	+70:56:03.99	15.40	WD	4400
A053	HE-2217-2818	22:20:06.75	-28:03:23.3	15.70	QSO	4000
A051	HD216532	22:52:30.41	+62:26:26.3	8.01	O8V	21000
A051	HD216898	22:55:42.31	+62:18:22.7	8.02	O8.5V	19000
A051	HD217035AB	22:56:30.85	+62:52:07.3	7.74	B0V	7000
A151	IPM-Crossflow_	2 22:59:30	-00:20:00		IPM	5000
A054	HD217411	23:00:35.6	-07:04:10.2	14.70	WD	4000
A023	NGC7673	23:27:41.59	+23:35:30.70	12.80	GAL	8734
A086	NGC7714	23:36:14.0	+02:09:19	13.80	GAL	4000
A023	NGC7714	23:36:14.10	+02:09:18.6	12.50	GAL	6248
A053	HS-2337+1845	23:39:44.76	+19:01:51.3	16.70	QSO	4000
A054	HD223816	23:53:04.4	-70:23:28.4	14.20	WD	4000
A153	TOO-COMET1	99:99:99	-99:99:99	9.00	SOL	60000
A019	TITAN	99:99:99.99	-99:99:99.9	7.70	SOL	45000
A090	Mars	99:99:99.99	-99:99:99.9	0.30	SOL	18000
A107	MOON	99:99:99.99	-99:99:99.9		SOL	12000
A093	GenericLMCNova-TO	99:99:99.99	-99:99:99.9	11.00	Nova	10000
A152	SN2000XX-TOO	99:99:99.99	-99:99:99.9	12.00	SN	47000

FUSE Calibration Target List

FUSE calibration targets marked with an asterisk (*) are also on the FUSE PI Team Cycle 2 reserved target list (Appendix D). Observations of these objects during Cycle 2 may not be released for public access until the normal 6-month proprietary period has passed.

The information listed below includes the Program Identification (PID), the target name, J2000 coordinates, cumulative exposure time planned for Cycle 2, which may include multiple visits, V magnitude, and an indicator of the spectral type. The PID permits cross-referencing of target to its **primary** calibration program, as indicated below.

PID	Target Name	RA(J2000)	DEC(J2000)	Cumulative Exposure Time (s)	V	Target Type
*M107	WD0005+5106	00 08 18.10	+51 23 17.0	2000	13.32	DO1
M103	BD-12D134	00 47 3.30	-11 52 19.0	300	11.78	DOZ1
*M101	GD659	00 53 17.20	-32 59 58.0	7800	13.37	DA1
M102	BPM70524	01 03 25.00	-06 32 12.0	13000	13.30	DB
M102	BPM17088	03 08 30.00	-56 34 0.0	13000	14.07	DB
*M103	NGC1360	03 33 14.70	-25 51 19.0	300	11.35	sdO
*M107	LSV46-21	04 43 21.00	+46 42 4.0	2000	12.90	DAO
*M103	RE0503-289	05 03 55.90	-28 54 36.0	900	13.90	DO1
*M101	G191-B2B	05 05 30.60	+52 49 54.0	2000	11.78	DA1
*M101	GD71	05 52 27.40	+15 53 23.0	12000	13.03	DA1
M104	BD+75D325	08 10 49.30	+74 57 57.5	2300	9.55	sdO
M103	AGK+81D266	09 21 19.30	+81 43 30.5	400	11.85	sdO
*M103	PG1034+001	10 37 4.00	-00 08 20.4	360	13.19	DO1
*M103	FEIGE-34	10 39 36.70	+43 06 10.1	300	11.12	DO
*M103	HZ21	12 13 56.50	+32 56 28.3	2400	14.22	DO1
M103	FEIGE-66	12 37 23.60	+25 04 0.3	300	10.51	sdO
M103	FEIGE-67	12 41 51.80	+17 31 20.5	300	11.81	sdO
*M101	GD153	12 57 2.40	+22 01 56.0	4800	13.35	DA1
*M101	HZ43	13 16 22.00	+29 05 57.0	2000	12.91	DA1
M104	HZ44	13 23 35.40	+36 08 0.0	20880	11.71	sdO
M102	GD190	15 44 19.00	+18 16 18.0	20000	14.72	DB
M103	HD149499B	16 38 30.50	-57 28 11.0	300	11.70	DO1

*M104 BD+28D4211	21 51 11.10 +28 51 51.8	2400 10.51 sdO
*M103 WD2211-495	22 14 12.30 -49 19 2.0	300 11.50 DA1
*M101 GD246	23 12 21.40 +10 47 5.0	2000 13.08 DA1
M103 FEIGE-110	23 19 58.40 -05 09 55.8	330 11.50 sdO

Notes:

O. With the exception of program M101, not all stars shown may be observed.

16. In the other programs a large number of stars are included for purposes of scheduling convenience.
17. Stars identified with a given program may be used for other programs, but are listed only once in the target list.
18. Many of the objects shown will also be used for additional calibration programs, such as measurements of mirror and grating scattering, focussing, FES photometric calibration, etc.

The calibration program IDs are the following:

M101: Photometric calibration, defined by DA white dwarfs.
M102: Photometric calibration, objects without Lyman lines (DB white dwarfs)
M103: Photometric calibration, monitoring by DO white dwarfs, G191, sdO stars
M104: Flat field, done by FP-splits of DO white dwarfs, sdO stars, etc;
M106: Wavelength calibration, emission-line objects
M107: Wavelength calibration, absorption-line objects

FUSE PI Team Science Program Abstracts for Cycle 2

This appendix summarizes the FUSE PI Team Science Program IDs, contact scientists, and program titles. This is followed by a text section with abstracts for each science program. The Program identifiers cross reference to the target listing provided in Appendix D.

FUSE PI Team Science Program Summary Listing

Program ID	Program Contact	Program Title
Major Programs		
P101	Sembach	The Properties of Hot Gas in the Milky Way and Magellanic Clouds (Galactic Halo)
P102/P122	Sembach	The Properties of Hot Gas in the Milky Way and Magellanic Clouds (Galactic Disk)
P103/P203	Sembach	The Properties of Hot Gas in the Milky Way and Magellanic Clouds (Magellanic Clouds)
P104/P204	Sembach	Deuterium Abundances and the D/H Ratio (Local ISM)
P105/P205	Sembach	Deuterium Abundances and the D/H Ratio (Galactic Disk)
P106	Sembach	Deuterium Abundances and the D/H Ratio (Galactic Halo)
P107/207	Sembach	Deuterium Abundances and the D/H Ratio (Snapshot Survey)
P108	Sembach	Deuterium Abundances and the D/H Ratio (Extragalactic)
P109	Sembach	Deuterium Abundances and the D/H Ratio (Solar System)
P110	Kriss	FUSE Studies of the Intergalactic Medium

FUSE Science Team Small and Medium Programs

P111	Kriss	Active Galactic Nuclei
P112	Oegerle	O VI in Cooling Flow Clusters
P113	Sonneborn	Circumstellar Interaction in SN 1987A
P114	Blair	Supernova Remnants
P115	Shull	Diffuse Molecular Hydrogen
P116	Snow	Molecular Hydrogen in Translucent Clouds
P117	Hutchings	Hot Stars
P118	Linsky	FUV Spectroscopic Survey of Cool Stars
P119	Vidal-Madjar	Circumstellar Disks
P120	Feldman	Solar System Objects
P123	Sonneborn	Supernovae as Probes of Galactic Halos

FUSE/Johns Hopkins Univ. Instrument and Operations Team Projects

P131	Friedman	Small-Scale Structure in the ISM
P132	Kruk	PG1159 Stars
P133	Bianchi	Planetary Nebulae Central Stars
P134	Murphy	Search for O VI Emission in the Halo of NGC4631
P135	Ake	Epsilon Aurigae

FUSE/U.C. Berkeley Instrument Team Projects

P151	Welsh	Supernova Remnant Absorption Studies
P152	Welsh	Herbig Be stars
P153	Griffiths	Active Late-Type Stars
P154	Siegmund	Flare Activity in Cataclysmic Variable Systems

FUSE/Univ. of Colorado Instrument Team Projects

P163	Wilkinson	T Tauri Stars
P164	Wilkinson	Zeta Aur Systems
P166	J. Green	X-ray Binaries

FUSE Co-Investigator Projects

P179	Dupree	Atmospheres of Cool Star Binaries
P180	Feldman	Target of Opportunity Observations of Comets
P184	Hutchings	Stellar Winds and CVs
P186	Linsky	Transition Regions of PMS and Pleiades Age Stars
P187	Malina	Pulsar and CV Observations
P191	Shull	Lyman Break in Star-Forming Galaxies
P192	Siegmund	T-Tauri Stars
P193	Snow	Studies of IS and CS Gas and Dust
P198	Vidal-Madjar	Blue Compact Galaxy and CSPN

FUSE French Guaranteed Time Projects

Q101	Gry	H2 Associated with Dust Color Variations
Q103	Vidal-Madjar	He I in the Local ISM
Q105	Deharveng	Lyman Break in Star-Forming Galaxies
Q106	LeBrun	O VI Phase in Galactic Haloes
Q107	Ferlet	H2 in the Small Magellanic Cloud
Q108	Vidal-Madjar	Central Stars of Planetary Nebulae
Q109	Vidal-Madjar	Peculiar White Dwarfs
Q110	Vidal-Madjar	Quasi-Molecular Satellite Lines in Lyman Beta
Q111	Ferlet	The Symbiotic Binary IX Velorum
Q112	Ferlet	Cataclysmic Binaries
Q113	Ferlet	The Old Nova V603 Aql
Q114	Ferlet	Be Stars
Q119	Deleuil	Circumstellar Disks
Q201	Vidal-Madjar	Cycle 2 French PI Team programs

Abstract listings:

Major Program: The Properties of Hot Gas in the Milky Way and Magellanic Clouds

The FUSE PI and Science Team will study the physical properties and distribution of hot gas in the interstellar media of the Milky Way and Magellanic Clouds through comprehensive absorption line studies of the O VI doublet and lower ionization lines in the FUSE bandpass. O VI is the best diagnostic of hot (log T = 5-6) gas in the ultraviolet spectral region. These observations will be covered under Team programs P101 (O VI Galactic Halo), P102/122 (O VI Galactic Disk), and P103 (O VI Magellanic Clouds).

The Team D/H and O VI programs will share data. Note that the exposure times given in this NRA listing for sight lines toward hot stars in P101, P102/122, and P103 are appropriate for S/N ~ 30 at full resolution (0.03 A) at 1032 A. Extragalactic sight line integrations in P101 will have S/N ~ 12-30. D/H observations of some objects in the O VI program will be several times longer than the listed integrations.

Program_ID: P101
Program_title: The Properties of Hot Gas in the Milky Way and Magellanic Clouds (Galactic Halo)
Program_contact: Sembach
Program_abstract:

This portion of the O VI program will focus on understanding the character of the O VI absorption in the Galactic halo along sight lines toward stars and extragalactic continuum sources such as AGNs and QSOs. Regions to be explored include the Galactic poles, the inner Galaxy, and the outer regions of the Milky Way halo. The data obtained for this program will be integrated with existing information from previous space missions to provide a global picture of the hot gas content of the Milky Way halo. A portion of the time for this program will be used to make measurements of the O VI emission from the diffuse halo gas, though this is a secondary objective since such measurements depend sensitively on instrument performance. There will be a large amount of auxiliary information obtained as part of the O VI halo program. The Science Team will rely heavily upon these data to undertake additional investigations of the chemical composition and physical properties of the ISM, the properties of hot stars and their winds, and the far-UV continua and absorption line properties of AGNs and QSOs. Data from this program will also be used as a snapshot for determining which extended sight lines are best suited for follow-up studies of the D/H ratio. (See abstracts for programs P104, P105, P111, P115, and P117 for additional details.)

Program_ID: P102
Program_title: The Properties of Hot Gas in the Milky Way and Magellanic Clouds (Galactic Disk)
Program_contact: Sembach
Program_abstract:

This portion of the O VI program will focus on understanding the character of the O VI absorption in the Galactic disk at distances greater than ~ 1 kpc from the Sun. The survey will provide information for a statistical study of the O VI absorption properties as well as detailed studies of regions already known to contain hot gas through X-ray emission measurements (e.g., SNRs, radio continuum loops). Local interstellar medium data from the D/H program will be used to understand the properties of the hot gas in the solar neighborhood. There will be an additional "mini-survey" of several binary systems at multiple epochs to search for the presence of broad shallow O VI absorption due to very hot interstellar gas through a precise tomographic reconstruction of the stellar absorption in the vicinity of the O VI lines. The Team will also check for variability in the stellar O VI lines by observing several objects with a range of spectral types several times during the mission. There will be a large amount of auxiliary information obtained as part of the O VI disk program. The Science Team will rely heavily upon these data to undertake additional investigations of the chemical composition and physical properties of the ISM and the properties of hot stars and their winds. Data from this program will also be used as a snapshot for determining which extended sight lines are best suited for follow-up studies of the D/H ratio. (See abstracts for programs P104, P105, P115, and P117 for additional details.)

Program_ID: P122
Program_title: The Properties of Hot Gas in the Milky Way and Magellanic Clouds (Galactic Disk)--continuation
Program_contact: Sembach
Program_abstract:
Program P122 is a continuation of program P102.

Program_ID: P103/P203
Program_title: The Properties of Hot Gas in the Milky Way and Magellanic Clouds (Magellanic Clouds)
Program_contact: Sembach
Program_abstract:
This portion of the O VI program will focus on understanding the character of the O VI absorption in the Magellanic Clouds. Approximately 20 sight lines will be investigated in the two galaxies. The sight lines will include superbubble structures with strong X-ray emission and field positions with little X-ray emission. The hot gas properties of the LMC and SMC will be compared to those derived for the Milky Way. There will be a large amount of auxiliary information obtained as part of the O VI Magellanic Cloud program. The Science Team will rely heavily upon these data to undertake additional investigations of the chemical composition and physical properties of the ISM in the Milky Way and Magellanic Clouds, as well as the properties of hot stars and their winds (See abstract for programs P115 and P117 for additional details.)

Major Program: Deuterium Abundances and the D/H Ratio

The FUSE PI and Science Team will determine the abundance of deuterium and the D/H ratio in a variety of galactic environments through comprehensive absorption line studies of the D I and H I Lyman series lines in the FUSE bandpass. The sight lines studied will have varying degrees of metallicity and different evolutionary histories. Various metallicity markers (e.g., Oxygen, Iron) and ancillary ISM information (elemental abundances, physical conditions, and gas kinematics) will be integral components of all D/H analyses undertaken by the Team. The sky coverage of these observations will be maximized to the greatest extent possible. The D/H program encompasses Team programs P104 (D/H Local ISM), P105 (D/H Galactic Disk), P106 (D/H Galactic Halo), P107 (D/H Snapshot Survey), P108 (D/H Extragalactic), and P109 (D/H Solar System).

Program_ID: P104/P204
Program_title: Deuterium Abundances and the D/H Ratio (Local ISM)
Program_contact: Sembach
Program_abstract:

This portion of the D/H program will provide information for sight lines confined to the local interstellar medium to determine the extent to which the D/H ratio varies within a few hundred parsecs of the Sun. These observations will significantly increase the amount of information available for local deuterium abundance determinations and will enhance the information for the local interstellar medium available from earlier Copernicus satellite studies. Objects to be used as background sources include cool stars, white dwarf stars, the central stars of planetary nebulae, and a few A-type stars.   Auxiliary uses for the data will include general ISM studies and a surveyof hot gas within the Local Bubble. (See abstracts for programs P102/122 and P115 for additional details.)

Program_ID: P105/P205
Program_title: Deuterium Abundances and the D/H Ratio (Galactic Disk)
Program_contact: Sembach
Program_abstract:

This portion of the D/H program will provide information for sight lines that extend beyond the local interstellar medium of the Galactic disk. The sight lines covered will sample gas in spiral arm and interarm directions several kiloparsecs from the Sun. Most of the objects observed will be OB-type stars. Data from program P102/122 (O VI disk survey) will provide an initial far-UV observation of a large number of sight lines. Many of these sight lines will be re-observed for longer integration times (a factor of 3-5x) as part of this program. All of the P102/P122 sight lines should be considered potential candidates for this study.

Program_ID: P106
Program_title: Deuterium Abundances and the D/H Ratio (Galactic Halo)
Program_contact: Sembach
Program_abstract:

This portion of the D/H program will provide information for sight lines that extend into the Galactic halo. The directions to be studied include sight lines toward stars at the Galactic poles as well as toward stars in the inner and outer regions of the Galaxy. Most of the objects observed will be OB-type stars. Data from program P101 (O VI halo survey) will provide an initial far-UV observation of a large number of sight lines. Many of these sight lines will be re-observed for longer integration times (a factor of 3-5x) as part of this program. All of the P101 sight lines should be considered potential candidates for this study.

Program_ID: P107/P207
Program_title: Deuterium Abundances and the D/H Ratio (Snapshot Survey)
Program_contact: Sembach
Program_abstract:

This portion of the D/H program will provide short observations of many AGNs and QSOs to check far ultraviolet flux levels and suitability of the objects as background continuum sources for extended integrations. The data produced from this snapshot survey will be used extensively as part of program P111 to study the flux distribution and intrinsic absorption properties of the AGNs and QSOs observed. (See abstract for program P111 for more information.) The Team will also use this data for studies of extragalactic O VI and H I absorption at low redshift.

Program_ID: P108
Program_title: Deuterium Abundances and the D/H Ratio (Extragalactic)
Program_contact: Sembach
Program_abstract:

This portion of the D/H program will provide extended observations of extragalactic continuum sources for measurements of the D/H ratio in the distant Galactic halo, high velocity clouds, and low redshift ($z < 0.3$) absorption systems. These observations will provide unique opportunities to measure the deuterium abundance in places that are difficult to observe through absorption line studies of sight lines toward hot stars. Data from this program will be used by program P111 for high quality measurements of the far-UV continuum and absorption properties of AGNs and QSOs. (See abstract for program P111 for more information.)

Program_ID: P109
Program_title: Deuterium Abundances and the D/H Ratio (Solar System)
Program_contact: Sembach
Program_abstract:

This portion of the D/H program will focus on determining the D/H ratio on Jupiter. The observation will consist of several planetary limb pointings. The Jupiter D/H measurement will provide a reference value for the ratio at the time the solar system was formed about 5 billion years ago.

Major Program: FUSE Studies of the Intergalactic Medium

Program_ID: P110
Program_title: FUSE Studies of the Intergalactic Medium
Program_contact: Kriss
Program_abstract:

FUSE will provide an opportunity to explore absorption by He II in the intergalactic medium (IGM) over the redshift range z=2-3. The planned observations will measure the mean opacity of the IGM in coarse bins over this redshift interval to study the patchiness of the IGM over different lines of sight as a function of redshift. Deep observations of one or more candidate QSOs will attempt to resolve the He II Ly alpha forest. These observations will discriminate between discrete structures and distributed gas as sources of the He II opacity. Detailed comparisons of the He II forest lines and the H I Ly alpha forest lines will be used to determine the ionization state of the absorbing structures and the shape of the ionizing UV background spectrum.

FUSE Science Team Small and Medium Programs

Program_ID: P111
Program_title: Active Galactic Nuclei
Program_contact: Kriss
Program_abstract:

The nearest, brightest active galaxies have inspired our current vision of the AGN paradigm. These same galaxies have been imaged with HST, have the highest S/N HST and IUE far-UV spectra, and have the best X-ray spectra. Prime goals for FUSE observations are the shape of the far-UV continuum, the strength and velocity of the O VI emission line, strengths of other far-UV lines such as C III 977 and N III 991, and the prevalence of intrinsic absorption and Lyman limits. FUSE observations will resolve velocity structure in the O VI absorbing gas, and in any neutral hydrogen gas. Observations of Seyfert 2s (in addition to NGC 1068) will search for strong line emission in O VI, C III, and N III indicative of shock-heated gas. FUSE will also be sensitive to any molecular gas (visible as H_2 absorption) along the line of sight. In BAL QSOs, FUSE will be able to measure the absorption in the EUV transitions of high ionization ions such as Si XII. The detailed observations of selected objects in this program will supplement the more general surveys of AGN being used to explore O VI absorption and the D/H ratio in the galactic halo.

Program_ID: P112
Program_title: O VI in Cooling Flow Clusters
Program_contact: Oegerle
Program_abstract:

We will search for the O VI 1032/1038 emission lines produced in the warm (300,000 K) intracluster gas in the cooling flow clusters A2597, A2199 and A1795. The existence of this warm component of the ICM has never been detected convincingly, although its presence is expected in the conventional models of cooling flows. These 3 clusters have strong cooling flows derived from their X-ray emission (>100 Msun/yr), as well as strong H-alpha emission from cool (10,000 K) gas in their cluster cores. Detection of the intermediate temperature gas at 300,000 K will provide a strong link between these temperature regimes, and important information on the thermal history of the gas in cooling flows.

Program_ID: P113
Program_title: Circumstellar Interaction in SN 1987A
Program_contact: Sonneborn
Program_abstract:

FUV emission from SN 1987A in the Large Magellanic Cloud will be observed to characterize the shock interaction between the high-velocity ejecta and circumstellar gas. We will attempt to observe O VI emission and the full blueward extent of the blue wing of Lyman-alpha, only part of which is observable with STIS because of the high expansion velocity of the ejecta (V>15,000 km/sec). Emission from recombination lines from the inner circumstellar ring may also be present. The nearest companion star (Star 3) will also be observed.

Program_ID: P114
Program_title: Supernova Remnants
Program_contact: Blair
Program_abstract:

The FUSE Team Project on supernova remnants includes an absorption study of the young Type 1a SN remnant SN1006 and studies of selected filamentary emission regions in evolved galactic SNRs. Observations of the "Schweizer-Middleditch" star behind SN1006 will be used to search for a broad absorption from Fe III 1123, using FUSE's high dispersion to resolve contaminating stellar photospheric lines from the broad line. The presence of this line would indicate iron in the cool ejecta of the supernova. Observations of key, well-studied SNR emission filaments will be used to study different kinds of shock wave-ISM interactions, including nonradiative and radiative shocks, and thermally unstable regions. FUSE coverage of a range of ions and ionization stages at high spectral resolution will provide a unique capability to diagnose the thermal, chemical, and kinematic properties of these interactions. Observations of an X-ray bright region will be used to search for faint, high-ionization lines never observed previously in spectra of SNRs.

Program_ID: P115
Program_title: Diffuse Molecular Hydrogen
Program_contact: Shull
Program_abstract:

The FUSE PI team will study interstellar H_2 absorption spectra of OB-stars in the Galactic halo, SMC, and LMC. The H_2 lines will be used to derive molecular abundances, the CO/H_2 and HD/H_2 ratios, rotational populations, rotational temperatures, gas densities, and UV radiation field in diffuse clouds. We will measure the molecular abundances, including CO/H_2 and HD/H_2, as a function of metallicity, and estimate the gas pressure (nT) in the low halo. We will also observe H_2 in planetary nebulae toward hot central stars.

Program_ID: P116
Program_Title: Molecuar Hydrogen in Translucent Clouds
Program_contact: Snow
Program_abstract:

The FUSE PI team will observe 31 stars which lie behind translucent clouds (i.e. clouds having total visual extinctions of around 2 magnitudes or greater), in order to determine the H_2 column densities (for all stars on the list) and the H_2 rotational excitations (for the brighter stars on the list). The total H_2 column densities will be applied to studies of gas-phase depletions and chemistry, while the rotational excitations will be used to analyze the physical conditions (e.g. cloud densities, temperatures, and radiation fields). In addition, the FUSE spectra will be used to determine far-UV extinction curves for the program stars, and data on lines of atoms and ions, as well as molecular transitions of species other than H_2, will be used in a comprehensive analysis of cloud abundances, depletions, and chemistry.

Program_ID: P117
Program_title: Mass Loss and Stellar Winds of Hot Stars
Program_contact: Hutchings
Program_abstract:

This program is intended to a) enable modelling of stellar winds from FUSE spectra combined with HST/IUE range spectra, which will yield proper determination of the wind ionization balance. The program stars are selected mainly from the LMC and SMC and will be combined with the Galactic star sample from other programs, to b) enable a comparison of winds in stars with matched spectral type and luminosity in the 3 different environments, since abundance is known to be an important parameter in driving winds. Spectral types range through WR, and O3 to B2. Exposures are designed to provide a minimum S/N of 30 over 0.2 Angstroms; in many cases this is exceeded.

Program_ID: P118
Program_title: Spectroscopic Survey of Cool Stars
Program_contact: Linsky
Program_abstract:
This program will obtain far-UV spectra of cool stars that span a broad range of spectral type and luminosity class. It is our intention to obtain these spectra early in the FUSE program and to provide the spectra quickly to the user community in order to guide potential guest investigators in designing their observing programs. The specific science objectives include: (1) studying transition region dynamics (winds and downflows), (2) modeling the thermal structure of transition regions, (3) measuring electron densities, (4) search for low temperature coronae, (5) studying molecular excitation and fluorescence processes, and (6) inferring how the transition regions of spectroscopic binary systems differ from those of single stars.

Program_ID: P119
Program_title: Circumstellar Disks Around Main-Sequence and Pre-Main-Sequence Stars
Program_contact: Vidal-Madjar
Program_abstract:
The purpose of this program is to provide new insight on the signatures of circumstellar gas around main-sequence and pre-main-sequence stars. For some stars, the already detected gas may be the by-product of some activity (like evaporation and/or collision of kilometer-sized bodies) in a young planetary system in its clearing out phase. Spectroscopic variations observed around the targets stars (PMS, Herbig AeBe) present strong similarities with the already observed ones, but the origin of the circumstellar gas within these systems is still unclear. Detection of deuterium may help in identifying the origin of the gas. These observations are expected to allow the identification of the main form of the gaseous phase (H_2, CO, OI, NI, CII ?) and provide information on the ionization equilibrium of the zero radial velocity as well as of the accreting gas. Analysis of multiplet ratios will allow to probe the sizes of the inflowing gas structures. Also, in order to better understand the evolution of circumstellar gas from young stellar objects to main sequence stars, a few very young B-type stars are included as being members of a binary system with a T-Tauri companion.

Program_ID: P120
Program_title: FUSE Solar System Studies
Program_contact: Feldman
Program_abstract:

H_2 emissions from both Jovian auroral regions measured with the high-throughput aperture (MDRS) will determine temperatures and self-absorption. Atomic H emissions from the bulge region measured by the high resolution aperture (HIRS) will determine the dynamics of the bulge and anti-bulge regions. The high-throughput aperture will be used to search for HD fluorescently pumped by solar Lyman-beta as well as to determine if there is a correlation of the H_2 Lyman and Werner bands with Lyman-alpha in the bulge region. The excitation of H_2 in the atmosphere of Saturn will be similarly studied. Io Torus emissions will be measured using the high-throughput aperture (MDRS) to determine ion velocity profiles and with the large science aperture to search for minor constituents. Observations of Venus will address the question of the atmospheric D/H ratio.

Program_ID: P123
Program_title: Supernovae as Probes of Galactic Halos
Program_contact: Sonneborn
Program_abstract:

FUSE observations of a newly discovered, bright (V<14) core-collapse supernova (Types II or Ib) will be used to study interstellar properties of the sightline. The full range of interstellar species present in the FUSE wavelength range will be utilized to examine kinematics, depletions, and abundances of foreground gas, the Milky Way halo, the ISM of the supernova's host galaxy, and the intergalactic medium. Any data obtained from this program will be made available to other FUSE programs to study the properties of the supernova outburst.

FUSE/Johns Hopkins Univ. Instrument and Operations Team Projects

Program_ID: P131
Program_title: Small-Scale Structure in the ISM
Program_contact: Friedman
Program_abstract:
The properties of the interstellar medium on scale sizes of about 1 pc are not well understood. Even as fundamental a parameter as the range of cloud sizes has not been measured properly. Some data suggest only weak opacity variations on scales of ~1 pc, and essentially none below 0.2 pc. Other data, especially in the UV and radio, suggest absorption line equivalent width variations as great as 25-50% toward targets with separations smaller than 3000 AU (~0.01 pc) at a distance of ~200 pc. The goal of this program is to observe closely spaced lines of sight toward spatially adjacent targets in an open cluster (NGC2264, distance=750 pc) in order to measure or place limits on various properties of clouds in the local interstellar medium. Among these properties are the sizes of the clouds and possible anomalous abundances. In addition, these observations may provide measures of metallicity and depletion gradients across the face of the cluster.

Program_ID: P132
Program_title: PG1159 Stars
Program_contact: Kruk
Program_abstract:
The hot metal-rich hydrogen-deficient white dwarfs known as PG1159 stars provide a unique probe of the late stages of stellar evolution. Present theories of stellar evolution do not yet produce stars that match the properties of PG1159 stars. FUSE observations will provide improved data on the surface compositions of these stars; in addition, the O VI resonance line profiles will be searched for evidence of ongoing mass-loss. The long exposure on WD2117+341 is used to search for the effects of the pulsations on certain diagnostic line profiles. The 2000s exposure on HS2324 is a snapshot: if the spectrum shows sufficient flux then some time will be reallocated within the program.

Program_ID: P133
Program_title: Planetary Nebulae Central Stars
Program_contact: Bianchi
Program_abstract:
Central stars of Planetary Nebulae (CSPN) are among the hottest stars in the H-R diagram. IUE and HST observations show that CSPN have significant supersonic winds and mass loss. Accurate measurements of the wind velocity and mass loss rate in CSPN are a crucial to test of whether current theories of radiation pressure accelerated winds apply to evolved, high gravity stars, and to understand the formation and evolution of the nebular shell, since the photons from the hot central star, and the momentum of its supersonic wind are responsible for the ionization

of the visible nebula, and influence the dynamics of the expanding shell. IUE and HST data give only partial information about mass loss, since they can only observe the (often saturated) resonance lines of CIV, SiIV and NV. FUSE can observe wind lines in a greater spread of species and ionization states, especially the hot O VI 1032,1037 doublet, from which the wind ionization can be determined accurately. UV (IUE/HST) and optical spectra are already available for a consistent analysis of photospheric and wind lines. The line profiles will be analyzed with different methods (SEI, SSBAL, EMISSEI) to derive wind velocity, mass loss rate, gravity, temperature and luminosity. Moreover, measurements of the stellar continuum in the FUSE range will yield better determinations of temperature and luminosity, both because of the hot temperatures of the stars, and because nebular continuum emission contaminates the flux of CSPN longwards of about 1400 Angstroms, but drops drastically below 1300 Angstroms. Therefore, FUSE spectra of CSPN can help our understanding of mass loss mechanisms, PN formation and evolution (physical interpretation of the morphology), nebular ionization, and post-AGB evolution.

Program_ID: P134
Program_title: Search for O VI Emission in the Halo of NGC 4631
Program_contact: Murphy
Program_abstract:
We propose to look for the O VI 1032/1038 emission lines from hot gas in the disk and halo of the edge-on spiral galaxy NGC 4631. ROSAT observations of NGC 4631 clearly show a concentration of soft X-ray emission north of the galaxy's plane directly above an area of high star formation activity. The X-ray spectrum implies the presence of a soft X-ray gas component at a temperature of less than 1 million degrees. Since O VI is the best diagnostic of gas at this temperature in the FUSE bandpass, our measurements of the O VI emission strength will help us to understand the physical state, total content, and scale height of hot gas in the halo of NGC 4631. These quantities can then be directly compared to values derived for the Milky Way through the O VI Program.

Program_ID: P135
Program_title: Epsilon Aurigae
Program_contact: Ake
Program_abstract:
FUSE will be used to study the nature of the unusual eclipsing spectroscopic binary, epsilon Aurigae. The most favored model of this system is that the secondary object is a large, cold disk seen nearly edge-on. IUE and GHRS observations indicate the existence of a far-UV excess compared to other A-F type supergiants, presumably from a hot star in the center of the disk. The main difficulty in interpreting the UV data is that the primary star still contributes significant flux down to 1400-1500 Angstroms. FUSE observations will perform a more direct examination of the secondary, free from contamination by from the photosphere of the primary star. Measurements will be made to determine the physical parameters of the central star, and study variability and gas motions in the disk.

FUSE/U.C. Berkeley Instrument Team Projects

Program_ID: P151
Program_title: Supernova Remnant Absorption Studies
Program_contact: Welsh
Program_abstract:

We will observe 4 early-type stars in the line-of-sight towards the Monoceros Loop supernova remnant in order to investigate the dynamics, ionization state and elemental abundances of the disturbed, absorbing interstellar gas associated with the remnant.

Program_ID: P152
Program_title: Herbig Be stars
Program_contact: Welsh
Program_abstract:
We will repeatedly observe 4 early-type Herbig Be stars which are thought to possess gaseous circumstellar disks. Our investigation will focus on the strong stellar FUV line profiles to determine the extent of time variability due to mass loss and accretion processes. We will also analyze the physical state of the molecular absorption lines sampled in the interstellar gas serendipitously observed in the line-of-sight to these objects.

Program_ID: P153
Program_title: Active Late-Type Stars
Program_contact: Griffiths
Program_abstract:
We will complete repeated exposures of the active late-type RS CVn stars AR Lac and HR 1099, and perform an extended exposure of the G8V star Xi Boo A. We will obtain a better description of the transition regions of these stars by completing the full emission measure distribution and accurately measuring the plasma electron density. We hope to gain a detailed understanding of the connection between magnetic activity at the photospheric and transition region levels, and will search for solar-like coronal mass streamers using O VI (1032,1038 Angstrom) line profiles.

Program_ID: P154
Program_title: Flare Activity in Cataclysmic Variable Systems
Program_contact: Siegmund
Program_abstract:
We will repeatedly observe one pre-CV and one normal CV eclipsing binary system to monitor the level of FUV flare activity that is routinely observed in these systems in other wavelength bands. We will observe the FUV emission from the surrounding gas disk and wind, the white dwarf companion, and a possible hot disk corona produced by EUV/X-ray radiation from the white dwarf that photoionizes and heats the disk surface.

FUSE/Univ. of Colorado Instrument Team Projects

Program_ID: P163
Program_title: T-Tauri Stars
Program_contact: Wilkinson
Program Abstract:
FUV spectra of pre-main sequence (PMS) stars show high temperature emission lines from magnetically heated regions and excited molecular lines from the circumstellar environment. The FUSE region is still largely unexplored for PMS stars and contains unique diagnostics such as the O VI doublet, H Lyman lines, and the H_2 Lyman bands. Our targets are the Classical T Tauri star T Tau and the Herbig Ae star HD104237. T Tau shows a rich UV spectrum of a wide range of ionic and H_2 lines, while the UV spectrum of HD104237 shows wind-dominated emission lines below 1500 A.

Program_ID: P164
Program_title: Zeta Aurigae Systems
Program_contact: Wilkinson
Program Abstract:
Zeta Aurigae/VV Cep eclipsing binary systems offer the most detailed method of studying mass loss from cool supergiant stars. The FUV continuum from the hot main-sequence secondary star provides a probe through the outer atmosphere and wind of the evolved primary star. The absorption spectra obtained will allow detailed investigation of the flow properties and ionization structure of these binaries, leading to improved mass-loss rates and wind energy budgets.

Program_ID: P166
Program_title: X-ray Binaries
Program_contact: J. Green
Program_abstract:
Observations of bright X-ray binaries will be used to determine the physical conditions in the companion star's wind and the effects of the high energy spectrum on the wind environment.

FUSE Co-Investigator Projects

Program_ID: P179
Program_title: Atmospheres of Cool Star Binaries
Program_contact: Dupree
Program_abstract:
The densities, mass motions, and emission measures will be evaluated for a selection of single stars and binary systems containing cool stars with various rotation periods to assess the effects of rotation upon the structure and energy balance of a stellar atmosphere. Most systems will be observed 3 times.

Program_ID: P180
Program_title: Target of Opportunity Observations of Comets
Program_contact: Feldman
Program_abstract:
FUSE will attempt to determine the argon/oxygen ratio in a target of opportunity comet whose activity level and orbit are suitable for the observation. In addition, we will search for molecular hydrogen released directly by the cometary nucleus and for neutral and singly ionized nitrogen. These measurements will be normalized to a water production rate derived from the observed hydrogen Lyman series.

Program_ID: P184
Program_title: Stellar Winds and CVs
Program_contact: Hutchings
Program_abstract:
Three stars in M33/M31 will be observed to study their stellar winds. The disk-dominated supersoft binary X-ray source 0513-69 in the LMC will be observed. Three CV binaries will be observed, with readouts at intervals which will sample their orbital and other variations. These targets are highly variable - maximum visible magnitude is given.

Program_ID: P186
Program_title: Transition Regions of PMS and Pleiades-Age Stars
Program_contact: Linsky
Program_abstract:
The objectives of this program are to study the dynamics, thermal structure, and energy balance in the transition regions of young stars, including pre-main sequence and Pleiades age stars. The observations will address these questions by measuring the far-UV fluxes, line widths, and Doppler shifts of the O VI and other far-UV transition region lines. We will be studying some young A-type stars to determine whether their transition regions differ from those of cooler stars, and will analyze any flares observed in these young stars and a reference late-M star.

Program_ID: P187
Program_title: Pulsar and CV Observations
Program_contact: Malina
Program_abstract:

PSR_0656+14: Measurement of surface thermal emission from neutron stars (NS) is essential to theories regarding the condensed matter state equation, the thermal evolution of NS, and of NS atmospheres. We propose to conduct 50 Ang band FUV photometric observations of PSR B0656+14, an X-ray, SXR and EUV bright isolated NS with an optical counterpart. FUV photometry will provide critical characterization of the NS's surface thermal radiation. Higher energy observations may be effected by poorly established effects including magnetized atmospheres, chemical compositions, temperature gradients and gravitational effects. Optical observations may be subject to non-thermal effects.

V3885 Sgr: V3885 Sgr is one of the brightest nonmagnetic cataclysmic variables. We propose to observe V3885 Sgr for 5 to 6 contiguous FUSE orbits, achieving a S/N of about 12 at full resolution even at the troughs of the source's O VI absorption lines in each spectrum (assuming 2000 sec visibility per orbit). The primary purpose of the observations is to use the source as a bright continuum against which to study local interstellar absorption lines. Although observed on Malina's Co-I Program, the data will be analyzed in collaboration with members of the O VI Project.

Program_ID: P191
Program_title: Lyman Break in Star-forming Galaxies
Program_contact: Shull
Program_abstract:

We will observe a blue, metal-poor, star-forming galaxy, Mrk 357 ($z = 0.053$) shortward of its (rest-frame) Lyman limit to measure or set limits on the Lyman continuum escape fraction. This fraction constrains the HI opacity and topology of gas layers in the parent galaxy and its halo, and it gauges the potential contribution of starbursts to the metagalactic (IGM) radiation field. A related goal is to use the spectrum longward of the Lyman limit for better understanding the star, dust and gas content of the galaxy.

Program_ID: P192
Program_title: T Tauri Stars
Program_contact: Siegmund
Program_abstract:

We shall observe two relatively unobscured T Tauri stars to investigate the emission from accreting hot gas known to be present in these systems from previous IUE data. Observations of these emission processes will help in understanding the role of circumstellar disk gas in these pre-main sequence systems.

Program_ID: P193
Program_title: Studies of Interstellar and Circumstellar Gas and Dust
Program_contact: Snow
Program_abstract:

Studies under this program fall into three distinct categories: (1) a detailed analysis, with enhanced S/N, of the spectra of two stars (HD 24534 = X Persei; and HD 23180 = o Per) for interstellar lines, with emphasis on weak molecular features and lines below 1000 Angstroms; (2) a study of absorption and emission in the spectra of three planetary nebula central stars; and (3) a search for UV diffuse bands as stationary features in the spectra of high- amplitude spectroscopic binaries.

Program_ID: P198
Program_title: Blue Compact Galaxy and CSPN
Program_contact: Vidal-Madjar
Program_abstract:

IZW18 is known to be a blue compact galaxy presenting a very low metallicity. The purpose of this investigation is to search for H_2 in the context of such a low metallicity, probably dust free object. A high velocity cloud is also present along this line of sight. These observations will allow the precise evaluation of a much longer exposure to further study both the galaxy and the intervening high velocity cloud.

Several programs can also be done simultaneously by observing the central stars of some bright Planetary Nebulae (PN):
(a) The wavelength range is particularly appropriate to study the continuum, the temperature and the wind of the PNe central stars;
(b) In addition to the stellar continuum, the spectra will yield information concerning the nebula;
(c) FUSE will offer the possibility to detect molecular hydrogen lines in absorption against the stellar continuum. It should then be possible to determine how much additional H_2 is formed by shocks in the stellar winds.
(d) Finally, the non-detection of deuterium should allow a direct check of its evolution within stars since these PN were selected for their different 3He environment.

FUSE French Guaranteed Time Projects

Program_ID: Q101
Program_title: H_2 Associated with Dust Color Variations
Program_contact: Gry
Program_abstract:

We propose to study the H_2 excitation, as well as the H_2 abundance and velocity istribution in nearby diffuse clouds in the Chamaeleon complex. The selected lines of sight present a wide variety in infrared colors, E(B-V), Rv and molecular abundances so that we can check the dependence of H_2 properties with these characteristics. After IRAS data revealed spatial variations in the dust emission color of these clouds, these variations have been correlated with changes in the shape of the UV part of the extinction curve, showing that they are due to variations in the size distribution of small dust particles. Comparative studies in the millimeter, visible and UV ranges have shown that highly energetic processes are present in the cloud presenting mid-IR excess. Magnetohydrodynamic shocks and intermittent dissipation of turbulence have been considered. The proposed study of H_2 in these clouds will help characterize these processes which should be of great significance for the evolution of dust particles and of the gas itself.

Program_ID: Q103
Program_title: He I in Local ISM
Program_contact: Vidal-Madjar
Program_abstract:

An attempt will be made on the brightest EUVE source showing emission in the 600 Angstrom EUVE band (410 c/ksec), to try to detect some second order absorption signature corresponding to He I in the local ISM.

Program_ID: Q105
Program_title: Lyman Break in Star-Forming Galaxies
Program_contact: Deharveng
Program_abstract:

We wish to observe a star-forming galaxy shortward of its (rest frame) Lyman limit in order to measure or set limits on the Lyman continuum escape fraction. An object with a redshift large enough to get rid of residual galactic gas absorption (lyman series) is selected. Another related goal is to use the spectrum longward of the Lyman limit for better understanding the star, dust and gas content of the galaxy.

Program_ID: Q106
Program_title: O VI Phase in Galactic Haloes
Program_contact: LeBrun
Program_abstract:
We propose to make low resolution (R=2000 and S/N~20) observations of two quasars, 3C 351 and Mark 205. Their sightlines cross the near environment of already known and identified galaxies or groups of galaxies, at impact parameters in the range 40-700 kpc (H0 = 50 km/s/Mpc). We will be able to detect the O VI doublet lines in absorption down to a limiting equivalent width of 0.2 Angstrom. We thus plan to determine whether a highly ionized phase exists in the close galactic environment in which the cooler and denser MgII absorbers would be embedded. These observations will also help in determining whether collisional excitation is present in these clouds and also to study the evolution of the shape and intensity of the intergalactic UV flux at low redshift.

Program_ID: Q107
Program_title: H_2 in the Small Magellanic Cloud
Program_contact: Ferlet
Program_abstract:
The star Sk 143 in the SMC has most peculiar properties: its extinction curve in the far-UV is of Galactic type, contrary to all the other SMC stars which have a small or absent extinction bump and a very strong rise in the extinction at shorter wavelength. It also has an apparently Galactic ratio of E(B-V) to atomic hydrogen column density. Still, the interstellar lines are at the SMC velocity, and suggest that the extinction is due to a molecular cloud in the SMC. However a deep integration in the CO(1-0) line with the Swedish-ESO submillimeter telescope has given a null result. FUSE will help solve this mystery by observing the H_2 lines and other lines which might yield a detection of the absorbing gas.

Program_ID: Q108
Program_title: Central Stars of Planetary Nebulae
Program_contact: Vidal-Madjar
Program_abstract:
Several investigations will be done simultaneously by observing the central stars of some bright Planetary Nebulae (PN):
(a)The wavelength range is particularly appropriate to study the continuum, the temperature and the wind of the PNe central stars;
(b)In addition to the stellar continuum, the spectra will yield information concerning the nebula. The CIII line at 977A should be easily observable. Its intensity will be an additional independent measurement to resolve the controversy about the carbon abundance in PN;
(c)FUSE will offer the possibility to detect molecular hydrogen lines in absorption against the stellar continuum. In several cases, the velocity separation of that component formed in the vicinity of the nebula and that formed in the general ISM will be possible. It should then be possible to determine how much additionnal H_2 is formed by shocks in the stellar winds.
(d)Finally, the non detection of deuterium should allow a direct check of its evolution within stars since these PN were selected for their different 3He environment.

Program_ID: Q109
Program_title: Peculiar White Dwarfs
Program_contact: Vidal-Madjar
Program_abstract:

The standard post-AGB evolution theory predicts that throughout the whole post-AGB phases the chemical surface composition of the star remains essentially unchanged, because hydrogen shell burning ceases when the surface H-rich layer has been thinned down to about 1.e-4 Msun. However about 25% of the spectroscopically observed post-AGB stars in the planetary nebula stage are hydrogen-deficient and the origin of their peculiar surface abundances is still unclear. Among the hydrogen deficient post-AGB stars the class of the PG1159 stars are the most peculiar. They cover the hottest part of the post-AGB evolution (65000 - 180000K) and their surface is composed of carbon, helium, and oxygen (typically 50/30/20% by mass). Since mass loss could also be responsible for the observed peculiarities, we need a determination of the mass-loss rate to be conclusive. The O VI line at 1034 Angstroms is best suited since it is the most sensitive indicator for mass-loss in these stars. In that frame we will observe PG1159-035 the prototype as well as H1504+65 which is the most extreme one of this class. Deuterium evaluations will be also made on the line of sights towards these stars.

Program_ID: Q110
Program_title: Quasi-Molecular Satellite Lines in Lyman Beta
Program_contact: Vidal-Madjar
Program_abstract:

Our purpose is to detect in the wing of Lyman Beta the signatures of absorptions due to the quasimolecular satellites of H_2+ and H_2 in, respectively, photospheric spectra of a white dwarf and a Lambda Boo star where they have been observed in wing of Lyman Alpha. These targets are suitable for such detection: the white dwarf WD1620-391 has a pure hydrogen atmosphere and that of HD125162 is depleted in metals.

Program_ID: Q111
Program_title: The Symbiotic Binary IX Velorum
Program_contact: Ferlet
Program_abstract:

The profiles of the absorption and emission lines, particularly of the O VI doublet for the symbiotic binary AG Peg, will enable information to be obtained on the kinematics of the regions of line formation. The very high ionization O VI doublet may in particular be produced very near the compact hot component. A wind from the cool component of the binary should be present; signs of the continuing existence of a wind from the hot component seen on older IUE spectra as well as a possible region where the winds collide, will be looked for.

Program_ID: Q112
Program_title: Cataclysmic Binaries
Program_contact: Ferlet
Program_abstract:

We propose to observe the highly mass-accreting cataclysmic binary IX Vel in the far UV, for the first time at a very high spectral resolution (R~30000), to infer the physics of the accretion very close to the white dwarf. A detailed analysis of the absorption resonance lines of O VI, PV and SVI by means of phase-resolved spectra (exposure time of 1/8 Porbital) will bring important clues to probe the structure of the wind (geometry, velocity law, inhomogeneities). When combined with the study of the continuum distribution in the far UV, this will allow us to test the still unknown mechanism of wind formation and to distinguish between different proposed models for the boundary layer which plays a major role in the dynamical evolution of these systems.

Program_ID: Q113
Program_title: The Old Nova V603 Aql
Program_contact: Ferlet
Program_abstract:

The absorption and emission line profiles of the old nova V603 Aql will be observed with FUSE in order to further study the properties of what appear to be an accretion disk and wind coming from this disk, also studied at longer wavelengths. Rapid line profile variations already seen for other lines in HST spectra, will in be searched for and examined, this being the case in particular for the O VI doublet.

Program_ID: Q114
Program_title: Be Stars
Program_contact: Ferlet
Program_abstract:

The study of high excitation line transitions in the wavelength range observed by FUSE will bring important information on the nature of activities taking place in the outermost layers of Be stars. The Lyman energy distribution predicted by thermal models of stellar atmospheres, which does not even agree with observations of normal B stars, will probably produce larger disagreements in Be stars, where, as highly rotating objects, the atmospheric structure remains quite unknown. A young B star in a binary system with a T-Tauri star will also be observed for the purpose of comparison. This program is also conducted in the frame of other observing programs toward B and Be stars.

Program_ID: Q119
Program_title: Circumstellar Disks
Program_contact: Deleuil
Program_abstract:

The purpose of this program is to give new insights on the signatures of circumstellar gas around main-sequence and pre-main-sequence stars. For the stars Beta Pic (HD39060) and 51 Oph (HD158643), the gas already detected may be the by-product of some activity (like evaporation and/or collision of kilometer-sized bodies) in a young planetary system in its clearing out phase. These observations are expected to allow the identification of the main form of the gaseous phase (H_2, CO, OI, NI, CII ?) and to give information on the ionization equilibrium of the zero radial velocity as well as accreting gas. Analysis of multiplet ratios will allow to probe the sizes of the inflowing gas structures.

H. EDUCATION/PUBLIC OUTREACH (E/PO) PROGRAM

H.1 Scope of Program

The Office of Space Science (OSS) has developed a comprehensive approach for making education at all levels (with a particular emphasis on K-14 education) and the enhancement of public understanding of space science integral parts of all of its research missions and programs. To this end, OSS invites and encourages all proposers to this NRA to include an Education and Public Outreach (E/PO) component in their research proposals. The two key documents that establish the basic policies and guidance for all OSS E/PO activities are a strategic plan, entitled *Partners in Education: A Strategy for Integrating Education and Public Outreach Into NASA's Space Science Programs* (March 1995), and an implementation plan, entitled *Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy* (October 1996). Both of these documents may be obtained by selecting *Education and Public Outreach* from the OSS homepage at http://spacescience.nasa.gov , or from Dr. Jeffrey Rosendhal, Office of Space Science, Code S, NASA Headquarters, Washington, DC 20546-0001.

The following policies and guidelines apply to the E/PO activities solicited through this NRA:

- The proposed E/PO activity is expected to have general intellectual linkage to the science objectives of its "parent" proposal and/or the science expertise of its PI;
- An E/PO activity may be funded only as an add-on to a new award for a "parent" research proposal; therefore, the period of performance of the E/PO activity is restricted to that of its parent award;
- Up to $10K per year may be proposed for an E/PO program, although larger budgets may be considered for a few exceptionally meritorious activities (Note: a Budget Summary must be submitted as part of an E/PO proposal as described further below);
- NASA requests (but does not require) that the submitting organization waive PI labor costs and its customary overhead charges on an E/PO budget, since in many cases such activities will directly aid a local educational or public science institution, and the budget available for this OSS E/PO program is extremely limited;
- The parent research proposal may identify an additional Co-Investigator who, along with the PI of the parent research proposal, will be responsible for completing the E/PO activities (e.g., an appropriately qualified colleague from the PI institution, or from an educational institution such as a public school district, science museum, planetarium, etc.);
- E/PO proposals will be evaluated (see criteria below) by appropriately qualified scientific, education, and outreach personnel, and the substance of these reviews will be conveyed to the proposers in a summary report; and

a) The OSS Selecting Official will take into account proposed E/PO tasks and their review ratings when deciding on final selections and funding levels and as an aid in discriminating between highly qualified research proposals having otherwise comparable merits.

H.2 Evaluation Criteria

****

IMPORTANT NEW INFORMATION

> OSS has developed a document, entitled *Explanatory Guide to the NASA Office of Space Science Education and Public Outreach Evaluation Criteria*, as a resource for proposers who want to submit an E/PO proposal in conjunction with their research proposal. This *Explanatory Guide* may be accessed through the OSS homepage Web site indicated above or directly at http://spacescience.nasa.gov/education/guide.html ; navigation through this *Explanatory Guide* at its Web site is facilitated by internal active links. This *Guide* is not an extension of the E/PO requirements or criteria but is meant to provide an easy-to-follow introduction to this program using a series of Frequently Asked Questions (FAQ), followed by a detailed discussion of the E/PO review criteria given below. All proposers who are considering the submission of an E/PO proposal but who are not familiar with the specific OSS standards for E/PO activities are urged to review this *Explanatory Guide*.

****

Based on the OSS E/PO strategy and implementation plans noted above, there are two classes of evaluation criteria against which proposed E/PO activities will be evaluated. Although creativity and innovation are certainly encouraged, <u>note that neither of these sets of criteria concerns the originality of the proposed effort</u>. Instead, NASA seeks assurance that the proposer is personally committed to the E/PO effort and that the PI of the parent proposal and/or appropriate research team members will be actively involved in carrying out a meaningful, effective, credible, and appropriate E/PO activity; that such an activity has been planned and will be executed; and that the proposed investment of resources will make a significant contribution towards meeting stated OSS plans and objectives (interested proposers to this E/PO program are urged to consult the *Explanatory Guide* referenced above).

<u>General Criteria</u>

The following <u>general criteria</u> will be applied to the evaluation of <u>all</u> proposals and reflect requirements necessary for further consideration by NASA OSS of an E/PO proposal:

- The quality, scope, and realism of the proposed E/PO program including the adequacy, appropriateness, and realism of the proposed budget;

- The capabilities and commitment of the proposer and the proposer's team to carry out the proposed E/PO program, including the direct involvement of one or more science team members in overseeing and carrying out the proposed E/PO program (Note: this criterion is intended to preclude proposals that serve only to "pass through" money to an external organization or individual who would carry out the proposed E/PO activity, since such a case is inconsistent with the intention of OSS that the research community be actively involved in education and public outreach);
- The establishment or continuation of effective partnerships with institutions and/or personnel in the fields of educational and/or public outreach as the basis for and an integral element of the proposed E/PO program; and
- The appropriateness of plans for evaluating the effectiveness and impact of the proposed education/outreach activity.

Specific Criteria

To ensure that the goals and objectives of the OSS E/PO strategy are realized in practice, E/PO proposals will also be evaluated using at least one of the following specific criteria, as appropriate, for the submitted proposal. Because of the modest financial scope of this program, not all E/PO proposals can (or even should) address all of these specific factors; a sound, well-posed, and focused effort that will clearly be effective in reaching its intended target audience is preferable to an unrealistically broad effort. These specific criteria are:

- For proposals dealing directly with or strongly affecting the formal education system (e.g., teacher workshops or student programs carried out at public institutions such as science museums and planetariums), the degree to which the proposed E/PO effort is aligned with and linked to nationally recognized and endorsed education reform efforts and/or reform efforts at the state or local levels;
- The degree to which the proposed E/PO effort contributes to the training, involvement, and broad understanding of science and technology by underserved and/or underutilized groups; and/or
- The potential for the proposed E/PO activity to expand its scope by having an impact beyond the direct beneficiaries (e.g., reaching relatively large audiences, being suitable for replication or broad dissemination, and/or drawing on resources beyond those directly requested in the proposal).

H.3 Options for E/PO Proposals

OSS expects that most E/PO proposals will be submitted by a single proposer as a supplement to a single science proposal submitted in response to this NRA. However, NASA OSS will allow a special option to this baseline pattern as discussed below (Note: as a departure from previous OSS NRA's, the so-called "Institutional" E/PO proposal option is no longer offered).

H.3.1 Submission of the Same E/PO Proposal with Multiple Research Proposals Submitted by the Same Proposer

OSS recognizes that a single proposer may submit more than one research proposal in response this NRA, or to different OSS NRA's over the course of a given calendar year. In such a case, that one proposer may submit the same E/PO proposal with all his/her research proposals subject to the three conditions that: (i) OSS will review such an E/PO proposal only the first time it is submitted; (ii) this one evaluation will carry through to all other submissions of that same E/PO proposal for this NRA as well as all other OSS NRA's to be issued in this calendar year; and (iii) such an E/PO proposal will be funded only once (i.e., NASA will not fund the same activity more than once even though it may be enhanced by such an increase in support). The Web page to be used for the submission of an E/PO proposal (see further below) will request information regarding the first submission and any subsequent submissions of this proposal to this NRA. Note that in such a case, the E/PO proposal must be resubmitted in the identical form as it was the first time; OSS does not have the resources to separately evaluate E/PO proposals that have only minor changes between such multiple submissions. Of course, multiple but substantially different E/PO proposals submitted by the same proposer will receive individual evaluations.

H.4 Assistance for the Preparation of E/PO Proposals

To help interested proposers in developing an effective E/PO proposals, NASA OSS has established a nationwide infrastructure of space science education/outreach groups to directly aid space science investigators in identifying and developing high quality E/PO opportunities. This infrastructure provides the coordination, background, and linkages for fostering partnerships between the space science and E/PO communities, and the services needed to establish and maintain a vital national, coordinated, long-term OSS E/PO program. The two elements of this system of particular interest to researchers interested in submitting E/PO proposals are:

- Four OSS science theme-oriented "E/PO Forums" that aid OSS in organizing the comprehensive education/outreach aspects of OSS space science missions and research programs, and provide both the space science and education communities with ready access to relevant E/PO programs and products; and
- Five regional "E/PO Broker/Facilitators" that search out and establish high leverage opportunities, arrange alliances between educators and OSS-supported scientists, and help scientists turn results from space science missions and programs into educationally-appropriate activities suitable for regional and/or national dissemination.

Prospective proposers are strongly encouraged to make use of these groups to help identify suitable E/PO opportunities and arrange appropriate partnerships and alliances but should note that the responsibility for actually developing the E/PO program and writing the proposal is that of the proposer. Points of contact and addresses for all of these E/PO Forums and Broker/Facilitators are found by opening *Education and Public Outreach* from the menu of the OSS homepage at http://spacescience.nasa.gov .

H.5 Preparation and Submission of an E/PO Proposal

As indicated elsewhere in this NRA, E/PO proposals may be submitted only by those proposers who are selected on the basis of the science merits of their proposal, and who have been, therefore, invited to submit a signed budget for their effort.

To aid interested proposers in composing and submitting a complete E/PO proposal, NASA OSS has established a comprehensive electronic form that is accessed through menu on the Web site http://www.lpi.usra.edu/panel/ . Completion of all the fields of this electronic form with the requested information and text (equivalent to approximately four pages) is necessary before a proposal may be submitted for evaluation (Note: only electronically submitted E/PO proposals will be evaluated). This site may be accessed at any time up to the due date for the budgets for the selected proposals. By using a unique identification number that will be provided at the time of first access, all fields may be edited up to final submission. The requested information may be transferred from any standard word processing software, although only text may be used to complete these fields on this Web site; i.e., this site will not accept illustrations or drawings. As an aid in developing the required information for the final electronic submission, this E/PO format may also be printed at any time.

This Web submission also requires a summary of the E/PO budget (both by year and total) using the same format shown for the research Budget Summary form shown in this NRA. It is not necessary to integrate the E/PO budget with that of its parent research proposal; however, it is necessary to state the summary E/PO budget (in total and by year) on the signed proposal *Cover Sheet* (see Appendix C) that will be required with the budget for the research proposal.

Once it is submitted, the completed E/PO proposal (including all Budget Summary sheets) can then printed out from the Web site by the proposer to provide the appropriate hard copy for submission either with their signed cover sheet and research proposal.

H.6. Reporting Activities for Approved E/PO Proposals

In order to assist OSS in obtaining a coherent picture of the entire portfolio of E/PO efforts supported across all OSS programs a brief report of selected E/PO activities are to be provided as part of the annual Progress Reports required for the parent research award (Note: it is expected that all such Progress Reports for the proposals selected through this NRA will be submitted electronically through a to-be-designated Web site). In addition, one of the OSS Education Forums (see above) will contact the PI's of selected E/PO components to obtain basic summary information concerning the nature of and intended audience for their selected E/PO effort.

H.7 Additional Information

General questions about this E/PO program may be directed to:

Dr. J. David Bohlin
Research Program Management Division
Code SR
Office of Space Science
National Aeronautics and Space Administration
Washington DC 20546-0001
Telephone: (202) 358-0880
E-mail: david.bohlin@hq.nasa.gov

Finally, attention is also called to the Initiative to Develop Education through Astronomy and Space Science (IDEAS) program administered by the Space Telescope Science Institute (STScI) on behalf of OSS. The IDEAS program is open to any space scientist based in the U.S. regardless of whether or not they hold a research grant from NASA OSS. This program, which selects proposals yearly, provides awards of up to $40K to foster the development of innovative approaches to space science education and outreach by space scientists and their educator partners. The annual solicitation for the IDEAS program is typically released in July with proposals due in October. The annual request for proposals is posted at. Inquiries may be addressed by E-mail to IDEAS@stsci.edu or by postal mail to: IDEAS Program, Office of Public Outreach, Space Telescope Science Institute, 3700 San Martin Drive, Baltimore MD 21218.